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EXTINCT HORSE, FOUND IN  
CENTRAL ALASKA

(WITH TWO PLATES)

BY

OLIVER P. HAY

Research Associate of the Carnegie Institution of Washington



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# DESCRIPTION OF THE SKULL OF AN EXTINCT HORSE, FOUND IN CENTRAL ALASKA

By OLIVER P. HAY

RESEARCH ASSOCIATE OF THE CARNEGIE INSTITUTION OF WASHINGTON

(WITH TWO PLATES)

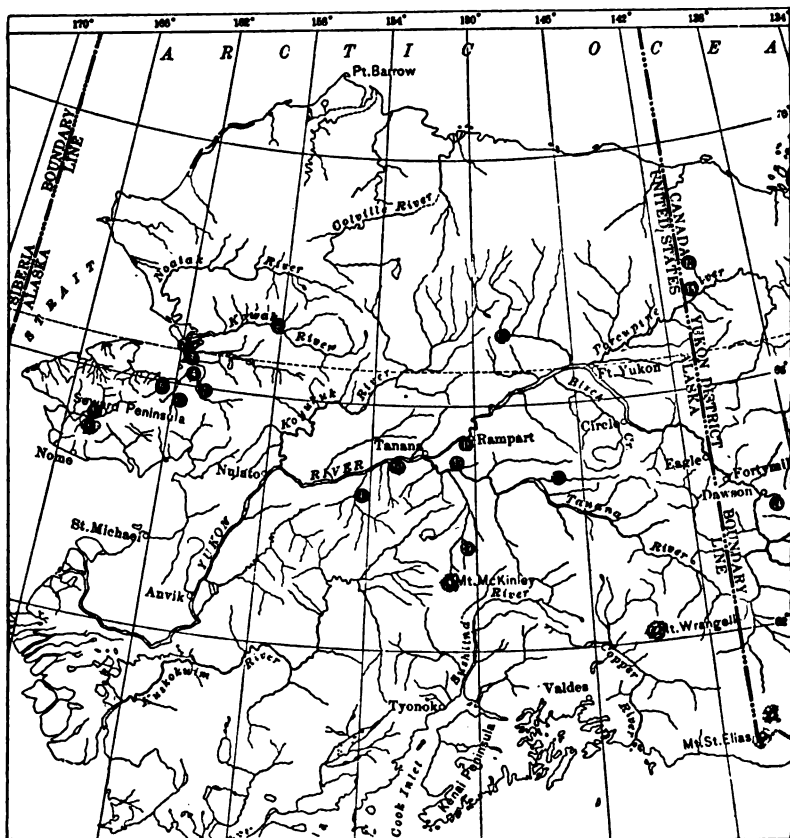
On January 25, 1913, there arrived at the U. S. National Museum the fossil skull of a horse which had been sent from the interior of Alaska. Hitherto our knowledge of Alaskan horses has depended on very scanty remains, such as single teeth, or a very few associated teeth, and a few bones, or fragments of them. These scanty remains had, however, been found at a considerable number of places; and, meager as they were, they showed that at some time in the past horses had been widely distributed in that apparently inhospitable region. A map is here presented (fig. 1) which shows the localities, where, as far as the writer knows, evidences of fossil horses have been found in Alaska and Yukon territories. Doubtless many remains have been discovered which have not been reported; and possibly a few announcements have escaped the notice of the writer.

The skull here described was discovered, in the course of mining operations, by Mr. C. P. Snyder, near Tofty, Alaska (fig. 1 (13)), a small mining town situated on Sullivan's Creek, about 24 miles southwest of Rampart and 7 miles northwest of Hot Springs. Rampart is on the Yukon River, about 4° east of the center of the territory. Sullivan's Creek empties into the Tanana River. The skull has been deposited for the present in the U. S. National Museum, and has been given the number 7700. In some of the cavities of the specimen is, an extremely fine-grained deposit; a fact which shows that the skull had been buried in the silts, which are so abundant along the great rivers of Alaska.

The skull (pls. 1, 2) lacks the lower jaws, also the greater part of both nasals, the ascending processes of the premaxillæ, and the upper borders of the maxillæ over the premolar teeth. Otherwise it is in fine condition. The bone is stained brown; and, while thoroughly mineralized, retains its original structure. Nearly all the sutures are yet open. The teeth, too, are in fine condition and in the most favorable stage for study. The animal appears to have been



After having made a careful study of the skull, taken many measurements and made careful comparisons with the accessible materials, the writer concludes that the animal probably belonged to the



species which he described recently (Proc. U. S. Nat. Mus., Vol. 44, pp. 569-593, pls. 69-73, and text figures) under the name *Equus niobrarensis*. Nevertheless, there appear to be certain differences which, although apparently not of specific value, make it proper to signalize this horse as a distinct form. It may be named and characterized as follows:

**EQUUS NIOBRARENSIS ALASKÆ, new subspecies**

Skull somewhat smaller than in the typical form; premaxillæ relatively wider, and differing in outline; region about articulation of the lower jaw and zygomatic arch modified.

The differences between this form and that found in Nebraska will appear in greater detail as the description proceeds. It is especially to be noted that the Alaskan horse is considerably smaller than the other. The type of *Equus niobrarensis* was found at Hay Springs, in northwestern Nebraska; but other members of the species have been recognized in teeth from western Texas, eastern Nebraska, and western Iowa. A lower molar, found at Wathena, Kansas, is referred to the same species. The deposits at Hay Springs are known as the Sheridan, or Equus, beds. The teeth from Iowa occur in the Aftonian, as do probably those from eastern Kansas and western Nebraska.

The following measurements have been taken from the skull and the teeth; and these are accompanied by the corresponding measurements of the type *Equus niobrarensis*, No. 4999, U. S. National Museum:

**MEASUREMENTS OF SKULL AND TEETH OF *E. niobrarensis*.**

	No. 7700 mm.	No. 4999 mm.
1. From middle of incisive border to rear of occipital condyles. . . . .	518	556
2. From middle of incisive border to front of foramen magnum. . . . .	498	530
3. From middle of incisive border to rear of hard palate. . . . .	268	290
4. From middle of incisive border to rear of occipital crest. . . . .	540	582
5. From middle of incisive border to line joining fronts of pm. <sup>3</sup> . . . . .	129	137
6. From middle of incisive border to line joining the rear of the orbits . . . . .	368	400
7. From middle of occipital crest to line joining the rear of the orbits . . . . .	174	181
8. Length of the orbit . . . . .	65	84
9. Distance between i. <sup>3</sup> and pm. <sup>3</sup> . . . . .	93	105
10. Width across post-tympanic processes . . . . .	117	119
11. Width across glenoid fossæ. . . . .	195	217
12. Width at rear of orbits . . . . .	220	240
13. Width at front of orbits. . . . .	158	158
14. Width on maxillary ridge at maxillo-malar suture. . . . .	182	187
15. Width of palate at m. <sup>3</sup> . . . . .	72	70
16. Width of palate at pm. <sup>3</sup> , least . . . . .	50	50
17. Width of palate at diastema, least. . . . .	54	45
18. Width from outside to outside of m. <sup>3</sup> . . . . .	124	123
19. Width from outside to outside of pm. <sup>3</sup> . . . . .	128	125
20. Width from outside to outside of canines. . . . .	68	—

21. Width from outside to outside of outer incisors.....	77	78
Length of premolar-molar series of teeth.....	170	179
Length of premolar series .....	95	98
Length of molar series .....	77	81
Pm. <sup>2</sup> , height .....	60	75
length .....	39	38
width .....	26.5	27
protocone .....	9.5	10
Pm. <sup>3</sup> , height .....	68	75
length .....	30	30
width .....	28	28
protocone .....	12	13.5
Pm. <sup>4</sup> , height .....	68	85
length .....	28.5	29
width .....	28.5	27
protocone .....	15	14
M. <sup>1</sup> , height .....	—	80
length .....	25.5	27
width .....	27.5	28
protocone .....	12	13
M. <sup>2</sup> , height .....	—	80
length .....	26	27
width .....	26	25
protocone .....	12	14
M. <sup>3</sup> , height .....	—	75
length .....	26.5	26
width .....	24.5	23
protocone .....	13	14
Canine, length, fore and aft.....	12	—
width .....	9	—
I. <sup>1</sup> , greater diameter .....	18	19
shorter diameter .....	10.5	13
I. <sup>2</sup> , greater diameter .....	22	20
shorter diameter .....	11	12
I. <sup>3</sup> , greater diameter along worn surface.....	24	21
shorter diameter .....	10	11

It seems proper to make some remarks regarding certain of these measurements. The orbit of the type of *Equus niobrarensis* appears to be much larger than that of the Alaskan specimen; but this is probably due to some distortion in the type. To the same is probably to be attributed the apparent narrowness of the skull of the type at the fronts of the orbits; likewise, the narrowness of the palate; while it is probable that the width at the rear of the orbit is somewhat exaggerated. The relatively somewhat greater width at the glenoid fossæ is hardly due to distortion.

The measurement numbered 2 is that called by Osborn (Mem. Amer. Mus. Nat. Hist., n. s., Vol. 1, p. 85) the basilar length; that



numbered 4, the vertex length; that numbered 6, the facial length; that numbered 7, the cranial length; that with the numeral 12, the frontal width. From these measurements we may obtain certain indices, viz., the cephalic index (measurement 12  $\times$  100  $\div$  measurement 2); the facio-cephalic index (measurement 6  $\times$  100  $\div$  measurement 2); and the cranio-cephalic index (measurement 7  $\times$  100  $\div$  measurement 2). These operations performed give us the following results. For comparison, there are included the same indices determined from the skull of a large Percheron gelding, No. 174960, U. S. N. M.; from the skull of an Arabian horse, No. 172454, U. S. N. M.; from four skulls of Grevy's zebra (*Equus grevyi*); from four skulls of Grant's zebra (*Equus burchelli granti*); and from three skulls of *Equus przewalskyi*.

These details are added for the purpose of contributing to the determination of the value of the various indices which have been employed in determining the races and species of horses. All the skulls employed in these estimates belong to the U. S. National Museum, except those of *Equus przewalskyi*. These are in the American Museum of Natural History, where the author has been kindly permitted to study them. The zebras were collected by the Smithsonian African Expedition of 1909, most of them by Mr. Edmund Heller.

INDICES OF SKULLS OF HORSES AND ZEBRAS

Indices	<i>E. niobrarensis</i>		<i>E. caballus</i>		<i>E. grevyi</i>			
	Type	E. n. alaskæ	174960	Arab	163228	163227	163331	163238
Cephalic index.....	45.2	44.2	40	43	39	40	38.3	37.2
Facio-cephalic index.....	75.4	73.9	75.3	75	75.7	76.1	77.6	76.8
Cranio-cephalic index.....	34.3	35	36.6	35.5	35.1	35.1	35.6	35.1
Palato-cranial angle, in degrees.....	14.5	11	19.5	15.3	18	29	22.5	21

Indices	<i>E. burchelli granti</i>				<i>E. przewalskyi</i>		
	161930	161932	162962	162955	136	32686	71
Cephalic index.....	40.9	40.2	41	40	43.1	43	43.2
Facio-cephalic index.....	74.2	75.6	76.3	74.3	76.9	77	76.2
Cranio-cephalic index.....	36	36.4	36.8	39.1	36.2	36	33.7
Palato-cranial angle, in degrees.....	6.5	20	18.5	17	19	15.5	17.5

As regards the cephalic index, it will be observed that, especially among the skulls of Grevy's zebra, there is a good deal of variation. It has been regarded as an animal possessing a very long, narrow skull; while Grant's zebra, to the eye, seems to have a rather broad

skull. Yet one of the four skulls of Grevy's zebra has the same relative breadth as one of Grant's zebra. When, however, the average of the four skulls of each species is taken, that of the skulls of Grevy's zebra equals 38.6, that of the skulls of the other zebra 40.5. It is, therefore, pretty certain that measurements made on a large number of skulls of the two species will show, as regards breadth, a decided specific difference. Nevertheless, individuals will be found which trespass the limits.

It will be noted that the relative breadth of the skull of the Przevalsky horse is much higher than that of either of the zebras, equaling that of the Arabian horse here measured. The specimens of *Equus niobrarensis* stand above all the others. On looking through the figures representing the facio-cephalic index, it seems to be hopeless by this means to distinguish species. The average for *Equus grevyi* amounts to 76.5; that of Grant's zebra, 75.1; that of Przevalsky's horse, 76.7. These figures seem, however, to exclude the possibility that the Alaskan skull belonged to *Equus przewalskyi*.

One of the skulls of the Przevalsky horse has a very low cranio-cephalic angle, and this reduces much the average for this species. The skull was that of a horse much younger than the other two, and this may have something to do with its shortness behind the orbits. The average for Grevy's zebra is 35.5; for Grant's, 37.1; for the Przevalsky horse, 35.3. All the four skulls of *E. grevyi* have this index less than any of those of Grant's zebra.

An examination of the figures representing the palato-cranial angle shows that there is, in some cases, great variation among members of the same species. Among the three individuals of *Equus przewalskyi* the range of variation is not wide, although there is much difference in age. The specimen numbered 32686 is regarded by Mr. Chubb, of the American Museum of Natural History, who has given much attention to the osteology of horses, as having had the age of thirteen years; number 136, twelve years; and number 71, four and one-half years. The differences do not, therefore, appear to be due to age, the youngest horse standing between the other two. In the case of the skulls of *Equus grevyi* there is a range of  $11^{\circ}$ . The youngest, No. 163227, yet retains the milk-teeth, but has the second upper molar through the bone. It has the highest angle,  $29^{\circ}$ . The next in age, No. 163238, had the last molar just beginning to wear and the third incisors not yet cut; its angle is  $21^{\circ}$ . The other two animals were of practically the same age, with all the permanent teeth in use and with the incisors yet cupped. The angles are, as seen, respectively,  $18^{\circ}$  and  $22.5^{\circ}$ .

The greatest range in the size of the palato-cranial angle is seen in the four skulls of Grant's zebra; and the greatest difference is seen to exist between No. 161930 and No. 161932. These two animals were mature, but not aged, of nearly the same age, both males, and both secured on the same farm in British East Africa. One has an angle of  $6.5^{\circ}$ ; the other an angle of  $20^{\circ}$ . It will be observed that this angle is relatively small in the type of *Equus niobrarensis* and in the skull from Alaska; but other skulls of the species might furnish quite different results.

The gelding and the Arabian agree in having the occiput-vertex angle equal to  $77.5^{\circ}$ ; the type of *Equus niobrarensis* and the Alaskan skull agree in having it equal to  $73.5^{\circ}$ .

The grinding teeth of the Alaskan specimen (pl. 1, fig. 2) resemble greatly those of the type of *Equus niobrarensis*. The table above given shows that those of the two skulls differ little in size. The outer styles are equally prominent in the teeth of both. In both skulls the protocone of the last premolar is longer than the protocones of the molars. In the two hinder premolars of both skulls, the post-protoconal valley is broad, has a deep re-entering loop in front, and sends a long branch to the center of the grinding surface. In both skulls these peculiarities of this valley are not so prominent in the molars as in the premolars, and slightly less so in the molars of the Alaskan skull than in the molars of the type. As regards the enamel surrounding the cement lakes, there appear to be no important differences. In the type skull the hinder border of the hinder lake in the first and second molars has a rather deep notch, while in the Alaskan skull this is absent or extremely small.

The incisors of the Alaskan skull (pl. 1, fig. 3) are in a slightly more advanced stage of wear than are those of the type skull. All have deep cups, that of the second incisor being 30 mm. deep. This incisor, evidently, had the hinder wall notched, as shown by a sharp groove in the rear of the tooth. The third incisor is worn down just to the bottom of the notch.

The width of the posterior nares, in front of the hamular processes, is 46 mm. In the type of *Equus niobrarensis* the width is 46 mm.; in the Arabian horse, 50 mm.; in the gelding, 60 mm. In the Alaskan skull the width across the occipital condyles is 80 mm.; in the type of *Equus niobrarensis*, 84 mm.; in the Arabian horse, 90 mm.; in the gelding, 99 mm.

The Alaskan skull differs from all the others here mentioned in the condition of the sagittal crest (pl. 2, fig. 1). The ridges which run



backward from the orbits do not coalesce on the parietals, but are separated by a space of about 8 mm. A ridge which runs forward from the occipital crest passes between these and finally disappears on the general surface. However, in examining a number of skulls of Grant's zebra, the cranium of which usually has a well-developed crest, two are found with the post-orbital ridges separated to the rear of the skull, but not so widely as in the Alaskan horse. One of these two zebra skulls belonged to a young animal, the other to one with the incisors well worn down.

It is observed also that the hinder border of the palate extends forward to nearly the middle of the second molars; while in the type of *Equus niobrarensis* it reaches only to the hinder end of this molar.

The premaxillæ in the Alaskan skull have the same absolute width at the incisors that these bones have in the type skull. The outline of the two jaws in this region are somewhat different, as seen from above.

The zygomatic arch, where narrowest, is 29 mm. wide in the Alaskan skull; while in that from Nebraska this arch is absolutely and relatively much wider, 37 mm. Its upper border above and behind the glenoid fossa is much thicker and more obtuse than in the type skull. The width of the occipital crest, at the suture between the superoccipital and the parietals, is equal to 68 mm. in the Alaskan skull; in the Nebraskan, 74 mm.; and the form is different in the two; especially does the occipital crest in the Nebraska skull project more backward.

The face of the type of *Equus niobrarensis* is more elevated than that of the Alaskan skull, the midline being at a height of 123 mm. above the rear of the palate, while in the Alaskan skull the height is 111 mm. This is 5 mm. more than is required by the greater length of the skull; but slight distortion of the skull as restored, or individual variation in either of the skulls, may easily account for the difference.

There are some distinct differences found in the glenoid fossæ of the two skulls here compared. In the type of *Equus niobrarensis* the articulatory surface has an extent, from side to side, of 63 mm.; in the Alaskan skull this is only 51 mm. In the Nebraskan skull this surface is so concave from side to side that a straight line from its extremities is, at one point, 8 mm. from the surface. In the case of the Alaskan skull such a line is nowhere more than 4 mm. from the surface. In the case of a considerable number of zebra and horse skulls examined, this region shows much constancy in form.

It has been suggested to the writer that the skull here described might belong to *Equus przewalskyi*. The thought readily suggests itself that this horse of eastern Asia might have crossed, with many other species of mammals, into America at a time when Bering Strait was temporarily abolished and that later it became extinct in this country. However, the Alaskan horse differs in many ways from *Equus przewalskyi*. The teeth are of practically the same size in the two forms, but the enamel of the Asian species has a still less complicated arrangement. The upper incisors are narrower and are curved more strongly downward. It is the writer's opinion that the horses and the bisons, probably also the mammoths and many other species, found in Alaska, became extinct about the middle of the glacial epoch.

They probably flourished during the Aftonian and the Sangamon stages.

In the U. S. National Museum are various teeth and fragments of jaws from Alaska. One lot of these (Cat. No. 2313, U. S. National Museum) consists of a part of the right maxilla, with the three molars (fig. 2). It was collected on Quartz Creek, in the Seward peninsula, by A. H. Jose, and presented to the U. S. Geological Survey. The locality is indicated on the map here presented (fig. 1) by the numeral (1). For an account of this locality see Mr. A. T. Collier, in Professional Paper, No. 2, U. S. Geological Survey, page 27. These teeth, also, the writer refers to *Equus niobrarensis alaskæ*, but they present some differences. The following are the dimensions:



Fig. 2. Three upper molars of right side, No. 2313, U. S. Nat. Mus.  $\times \frac{1}{2}$

#### MEASUREMENTS

Molar series, length .....	.58
M. <sup>1</sup> , height .....	.24
length .....	.26
width .....	.26.5
protocone .....	.13
M. <sup>2</sup> , height .....	.51
length .....	.25
width .....	.25
protocone .....	.15
M. <sup>3</sup> , height .....	.58
length .....	.28
width .....	.24
protocone .....	.15

It will be seen that these teeth are slightly smaller than those of both the type of *Equus niobrarensis* and those of the Alaskan skull from Tofty. Likewise the protocones are longer, equaling the length of that of the fourth premolar of the Tofty skull. These teeth have, too, a greater complication of the enamel which bounds the opposed faces of the two cement lakes. That on the hinder face of the front lake is especially folded, forming five loops. However, it is only a little more complicated than that of the lakes of the first molar of the Tofty skull.

The numeral (2) on the map here shown marks Hotham Inlet, latitude 162° West, where, close to the Arctic Circle, Mr. L. S. Quackenbush (Bull. Amer. Mus. Nat. Hist., Vol. 26, p. 121, pl. 18) found, in very barren deposits, the metatarsal bone of a horse. This specimen, as well as others found by Mr. Quackenbush, are in the American Museum of Natural History, New York.

Various specifically unidentifiable remains of fossil horses have been found around Eschscholtz Bay. The earliest mentioned were discovered by Captain Beechey and his companions in 1827 at Elephant Point. The parts then found were an astragalus, a metacarpal, and a metatarsal. They were mentioned and figured by Buckland in the second volume of the Narrative of the Voyage of the Blossom, p. 597, pl. 3, figs. 13-15.

The same region was visited by the ship "Herald," in 1848; and some bones of horses, together with those of various other extinct animals, were found. These were described by Sir John Richardson in the Zoölogy of the Voyage of the Herald, pp. 17-20. Of the horse he described a sacrum, a right os innominatum, a part of a right ischium, a radius and part of the attached ulna, a whole tibia and parts of four others, two astragali, and a part of a metatarsal. To these were applied simply the name, *Equus fossilis*. All these specimens are in the British Museum of Natural History (Lydekker, Cat. Foss. Mammalia, Brit. Mus., pt. 3). None of these seem to have been figured.

In the summer of 1907 Mr. L. S. Quackenbush explored the region around Eschscholtz Bay in the interests of the American Museum of Natural History, New York. His report was published in the bulletin of that museum, Vol. 26, 1909. On the north shore of the bay, eastward of Chloris Peninsula, he found some remains of an undetermined species of horse. In the same locality he found *Elephas*, *Bison*, *Ovibos*, *Rangifer*, *Canis*, and *Castor* (op. cit., p. 106). This locality is marked by the numeral (3) in the map here shown.

On the south side of Eschscholtz Bay, from Elephant Point eastward, Quackenbush (op. cit., p. 94, *seq.*) collected various remains of *Equus*, foot bones, a cervical vertebra, some loose teeth and a fragment of a lower jaw, with the premolars. The grinding faces of these teeth are shown in fig. 3. The teeth were well worn down. The height of the jaw at the front of the last molar is 90 mm.; at the front of pm.<sub>4</sub>, 78 mm.; at the front of pm.<sub>2</sub>, 45 mm. These measurements indicate a horse with a more slender jaw than that found in the type of *Equus niobrarensis*. This is to be expected on account of the evidently greater age of the animal; but in the type the width at the front of pm.<sub>2</sub> is 67 mm., in place of 45 mm., in the fragment here described. The following are the measurements of these teeth:

Pm.<sub>2</sub>, height 10 mm., length 33 mm., width 13.5 mm.

Pm.<sub>3</sub>, height — length 26 mm., width 15 mm.

Pm.<sub>4</sub>, height 35 mm., length 26 mm., width 15.5 mm.

These teeth appear to belong to *Equus niobrarensis alaskæ*, although the arrangement of the enamel is somewhat less complicated than in the horse from Nebraska.

The same explorer found indications of the horse along Buckland River (fig. 1 (7)), together with *Elephas*, *Bison*, *Rangifer*, *Ovibos*, *Alce*, *Ursus*, *Canis*. Mr. Quackenbush visited also the region south of Spafarief Bay, along the basin of the Keewalik River (fig. 1 (6)) and the Kugruk River (fig. 1 (5)). From both regions he reported *Equus* remains. Along Candle Creek, a branch of the Keewalik, he found an upper premolar, probably the third or the fourth. The height is 81 mm.; the length, 29 mm.; the width, 26 mm.; the length of the protocone, 14.5 mm. It is curved so as to be concave on the inner and the hinder faces. It is referred provisionally to *Equus niobrarensis alaskæ*.

In the U. S. National Museum are two horse teeth, which were collected somewhere in the region about Kotzebue Sound, or probably Eschscholtz Bay, and presented by the Board of Education of the Department of the Interior. One is a second upper left premolar, with a length of 40 mm. and a width of 26 mm. on the grinding surface. There is nothing to distinguish it from the same tooth of *Equus caballus*, although it is not probable that it belonged to that species. The other tooth, a lower left molar or premolar, differs from that of the domestic horse, and resembles that of *Equus niobrarensis*.



Fig. 3. Three lower premolars, No. 14337, Amer. Mus. Nat. Hist. x 4

Mr. C. W. Gilmore, who led an expedition into Alaska in 1907, reported (Smithsonian Misc. Coll., Quarterly Issue, Vol. 2, p. 31) that fossil horse remains, a single bone or two, now in the U. S. National Museum, were found on the Kowak, or Kobuk, River (fig. 1 (8)). He also ascended the Nowitna River, a southern affluent of the Yukon, a distance of about 180 miles and found, on the sand bars, remains of horse, mammoth, extinct bison, etc. (fig. 1 (9)). Mr. Gilmore further reported the finding of *Equus* remains along the Palisades on the Yukon (fig. 1 (10)). These

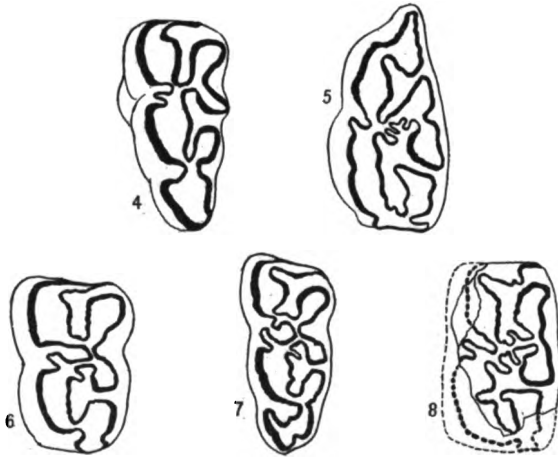


FIG. 4.—Left last lower molar, No. 866, U. S. Nat. Mus.  $\times \frac{3}{4}$ .

FIG. 5.—Left lower second premolar, No. 2645, U. S. Nat. Mus.  $\times \frac{3}{4}$ .

FIG. 6.—Left lower tooth, probably first molar, No. 2645, U. S. Nat. Mus.  $\times \frac{3}{4}$ .

FIG. 7.—Left lower third molar, No. 2645, U. S. Nat. Mus.  $\times \frac{3}{4}$ .

FIG. 8.—Left lower tooth, premolar or molar, No. 2645, U. S. Nat. Mus.  $\times \frac{3}{4}$ .

Palisades begin about 35 miles below Tanana. The materials secured by Mr. Gilmore included no teeth and are specifically indeterminable.

In the U. S. National Museum is a part of the left side of the lower jaw of a horse and in it is found the last molar. The catalogue number is 866. In an older catalogue the information is given, under the number 6563, that this jaw was collected in the region of Rampart (fig. 1 (11)). It was secured by Dr. William H. Dall, who tells the writer that the discoverer of the jaw was Mr. J. Lockhart, an old trapper in the employ of the Hudson Bay Company. The tooth is worn down to a height of about 45 mm. The length of the grinding surface (fig. 4) is 37 mm.; the width in front is 16 mm. This is greater by about 3 mm. than the width of the same tooth in the type of *Equus niobrarenensis*; but that tooth may not have yet reached its full width. No other differences of importance are observed.



The catalogue number, 2645, in the U. S. National Museum, belongs to a lot of four lower teeth, which were collected by Mr. A. G. Maddren for the museum in 1904, on the Old Crow River, in Yukon Territory, not far from the boundary line between this territory and Alaska (fig. 1 (12)).

It seems probable that three of these teeth belonged to one individual, the fourth to another and much younger one. The three are represented by figs. 5-7, the fourth tooth by fig. 8. One of the three (fig. 5) is the second premolar, another (fig. 7) the third molar, the other (fig. 6) probably the first molar; and all belonged to the left side of the lower jaw. The following are the dimensions of these teeth:

#### MEASUREMENTS

Pm. <sub>2</sub> , height	.....	.53
length	.....	.38
width	.....	.17.5
M. <sub>1</sub> , height	.....	.56
length	.....	.30
width	.....	.17
M. <sub>3</sub> , height	.....	.65
length	.....	.33.5
width	.....	.14

On comparing the figure of pm.<sub>2</sub> (fig. 5) with that of the same tooth of the type of *Equus niobrarensis* (Proc. U. S. Nat. Mus., Vol. 44, p. 579, fig. 20) it will be seen that the Alaskan tooth is broader and has somewhat more complicated enamel. The supposed first molar (fig. 6) differs from that of the type of *Equus niobrarensis* in having slightly more complicated enamel bands, but especially in having the valley which enters the tooth from the outside pushed between the two longitudinal valleys and nearly to the enamel of the opposite side. In about the same way the last molar (fig. 7) differs from that of the Niobrara horse. It does not appear probable that these teeth belonged to *Equus niobrarensis alaska*.

The fourth tooth (fig. 8) evidently belonged to a younger horse, having been worn down very little. It is considerably damaged, but the essentials of its structure can be made out. The height of the tooth is 82 mm.; the length is about 34 mm.; the width, 11 mm. The drawing will show the extreme complication of the enamel. It is probable that it is the tooth of a third Alaskan species.

During the summer of 1912 Mr. Copely Amory, Jr., made a small collection of fossil mammal bones on the Old Crow River, about fifty miles above its mouth. Among the animals represented are the mammoth, bison, a camel, and one or more horses. The horse

remains consist of a tooth, a part of a femur, parts of two tibia, two astragali, three proximal, and two second phalanges. The tooth presents all the characters of an upper left premolar of *Equus niobrarensis alaskæ*. The grinding surface is 28 mm. long and 28 mm. wide. The protocone is unusually long, 16 mm.

Mr. L. S. Quackenbush (op. cit., p. 91) states that he collected a fragmentary pelvis of a horse on the tailings of a mine, at Fox Gulch, not far from Dawson, Canada (fig. 1 (14)). The fossil bones occur here in a muck, which overlies a bed of gravel. They are sometimes found partly imbedded in the gravel.

Lydekker (Cat. Foss. Mamm., Brit. Mus., pt. 3, pp. 78, 86, 87) records the presence, in the British Museum of Natural History, of part of the right ramus of the lower jaw of a young horse, a part of a metatarsal, and a first phalange. These had been collected many years ago by Rev. R. McDonald, on the Porcupine River, Canada. The locality is not more exactly indicated; but it was probably not far from New Rampart House (fig. 1 (15)).

On a map, which forms a part of his paper already referred to several times, Mr. Quackenbush indicated (pl. 25) the localities in Alaska and Yukon where up to that time horse remains had been discovered. Four of these localities remain to be noted here. The first of these (fig. 1 (16)) is in the Seward Peninsula, on the Pilgrim River, south of the Kuzitrin River. To Mr. Quackenbush there was presented, by a civil engineer, Mr. A. Gibson, in whose statements he had full confidence, a tooth of a horse, which had been found on the river mentioned, and which is now in the American Museum of Natural History.

The three following localities were reported by the well-known collector, Mr. Charles Sheldon, to Prof. Henry F. Osborn, and communicated by him to Mr. Quackenbush. At some point on the Chandler River (fig. 1 (17)), at about latitude  $67^{\circ}$  north and about longitude  $149^{\circ}$  west, Mr. Sheldon found a terminal phalanx of a horse; and this he presented to the American Museum of Natural History. From some point along the Chena River (fig. 1 (18)), east of Fairbanks, somewhat south of latitude  $65^{\circ}$  north and not far from longitude  $147^{\circ}$  west, Mr. Sheldon reported the skull of a fossil horse. Where this skull now is the present writer does not know. Likewise, evidences of the existence of a fossil horse were found by Mr. Sheldon somewhat north of Mount McKinley. This was apparently not far north of latitude  $63^{\circ}$  north and somewhat west of longitude  $150^{\circ}$  west (fig. 1 (19)).

Mr. Quackenbush kindly informs the writer that a trader gave him a fossil horse tooth, which had been picked up on the ocean side of an island at the mouth of Schismareoff Inlet. Mr. Quackenbush regarded it as possible that the tooth had been carried there by floating ice; consequently, the locality is not recognized on the map.

At the American Museum of Natural History, New York, the writer saw three fragmentary horse teeth, which had been brought back by the Stefansson and Anderson Expedition and found about fifteen or twenty miles southwest of Point Barrow. Since, however, these teeth were discovered on the sites of Eskimo villages, it is probable that they had been taken there by human agency. For this reason this locality is not placed on the map.

One who studies the animals, living and extinct, of Alaska, is naturally led to consider those found on the other side of Bering Strait. The writer has not had the time and opportunity to enter into this subject thoroughly. He has, however, examined the descriptions and figures of fossil horses which were prepared by Tscherski (Mem. Acad., St. Petersburg, ser. 7, Vol. 40, pp. 257-380, pls. 5, 6). This author had in his possession a skull, well preserved and lacking few important parts, which had been obtained on Liakhof Island, situated in the Arctic Ocean, latitude  $73^{\circ}$  north, longitude  $140^{\circ}$  east. This is more than a degree farther north than Point Barrow, Alaska. The horse to which the skull belonged was supposed to be eight or nine years old. Tscherski figured this skull in three positions and presented a view of the grinding surfaces of the upper premolars and molars. He likewise described the skull in great detail and gave numerous measurements of its parts and of the corresponding parts of many other horses, existing and fossil. The skull had a basilar length of 502 mm., only 4 mm. more than the Alaska skull. It is, therefore, easy to make comparisons between the two. The width at the rear of the orbits is 216 mm., slightly less than in the Alaska skull; the cephalic index is, therefore, 43 instead of 44.2 mm. This difference is due to the fact that in the Liakhof Island horse the hinder part of the rim of the orbits does not project beyond the zygomatic arches, as it does in the Alaska skull. Tscherski attached considerable importance to this feature; but a study of the skulls of a number of Grant's zebras seems to show that in this respect, as in so many others, there is a good deal of variation. The facio-cephalic index in the Liakhof skull is 73.1; in the Alaska horse, 73.9. Tscherski measured carefully the postorbital bar, the height of the zygomatic arch below the orbit and behind it, and obtained indices thereof and compared them with those obtained from other horses;

but it needs only an examination of such a set of zebra skulls as have been gathered at the U. S. National Museum to convince one that there exists in probably every species of *Equus* great individual variations in the regions under consideration.

In the Liakhof horse the width of the skull at the articulation for the lower jaw is 14 mm. greater than in the Alaska skull. The width across the hinder ends of the nasals, taken in a straight line, is 118 mm. in the Alaska skull; in the Liakhof skull it is given as 126? The orbit in the Alaska skull is smaller than that of the other, the horizontal measurements being respectively 66 mm. and 67 mm.; the perpendicular, 55 and 61. The face of the Alaska horse appears to have less height than that of the Liakhof horse, the height measured at the rear of the last premolar, being in the former, 132; in the latter, 140 mm. The nose of the Alaska skull appears to have been, somewhat longer (from front of the premaxillæ to the front of pm.<sup>2</sup>) than in the other skull, being 134 mm. as compared with 129 mm., a relatively small difference. The length of the diastema between i.<sup>3</sup> and pm.<sup>3</sup> is the same in both. Tscherski notes, in the skull discovered by him, a concavity which occupied a considerable area just above the maxillary ridge. In the Alaska skull there is a corresponding cavity somewhat larger and deeper. In some specimens of Grant's zebra this region is strongly convex; in others, it is slightly concave. It is possible, of course, that a character variable in one species will be constant in another. The face of the Liakhof skull is somewhat wider on the maxillary ridge than in the Alaska skull, being 191 mm. as compared with 182 mm. These maxillary ridges extend farther forward in the Alaska skull than in the other, reaching nearly to the middle of the hinder premolar; in the Liakhof skull, to about the middle of the first molar.

The hard palate of the skull last named ends in the midline opposite the middle of m.<sup>3</sup>; in the Alaska skull it ends opposite the hinder end of the protocone of m.<sup>3</sup> The distance from the front of the foramen magnum to the hinder edge of the hard palate is almost exactly the same in the two skulls. From the front of the foramen to the edge of the vomer, at the midline, the distance is 131 mm. in the Liakhof skull; in the Alaska skull, 121 mm. From the same point of the vomer to the edge of the hard palate is 109 mm. in the Liakhof skull; in that from Alaska, 114 mm. In the last-named skull the index obtained by dividing the smaller distance multiplied by 100, by the greater is 83.2; in the former skull, 94.2. It remains to be proved that this difference is of specific value. Tscherski stated that the incisive foramina, or fissures, in the skull which he described

were extraordinarily short, 30 mm.; while in other horses examined by him the length ranged from 41 mm. to 53 mm. In the Alaska skull these slit-like openings are 29 mm. long. In a number of skulls of Grant's zebra these fissures vary greatly in length.

It remains to compare the teeth of the Liakhof skull with those of the Alaskan. They differ little in measurements. The length of the premolar-molar series in the former, measured in a straight line, is 170 mm., exactly that of the Alaskan skull. In the following table the measurements of both are given for easier comparison.

#### MEASUREMENTS OF TEETH

Teeth	Liakhof horse mm.	Alaskan horse mm.
Pm. <sup>2</sup> , length .....	41	39
width .....	24	26.5
protocone .....	10	9.5
Pm. <sup>3</sup> , length .....	27	30
width .....	29	28
protocone .....	13	12
Pm. <sup>4</sup> , length .....	26	28.5
width .....	30.5	28.5
protocone .....	14	15
M. <sup>1</sup> , length .....	24	25.5
width .....	28.5	27.5
protocone .....	13.5	12
M. <sup>2</sup> , length .....	23.5	26
width .....	27.5	26
protocone .....	15	12
M. <sup>3</sup> , length .....	29	26.5
width .....	25	24.5
protocone .....	16	13

It will be seen that there are no remarkable differences in the dimensions of the teeth, probably not greater than would be found in different individuals of the same species. The Liakhof skull, having belonged to an older horse, would naturally be expected to have the anterior premolar and the hinder molar longer, and the others shorter, on the grinding surface, than the younger horse. The protocones are of about the same length, except that those of the hinder molars of the Liakhof skulls are 3 mm. longer than those of the Alaskan skull.

As far as can be judged from Tscherski's figure the arrangement of the enamel around the two cement lakes of each tooth appears to be not especially different from that seen in the Alaskan skull. A considerable difference is seen, however, in the valleys which enter the interior of the tooth on the inner side. The median, or postproto-

conal, valleys of the teeth of the Liakhof skull are not so wide as those of the Alaskan skull and do not extend nearly so far toward the center of the tooth. The little bay entering the tooth behind the hinder inner pillar (hypocone) is much narrower in the Liakhof horse than in the Alaskan. Likewise the bay entering the tooth in front of the protocone is narrower, and the anterior end of the protocone extends further forward inside of it.

Tscherski attached much importance to the feature just mentioned, the elongation of the anterior end of the protocone, and proposed an index to express this. He measured the distance from the hinder border of the tooth to the anterior border of the protocone and divided this, multiplied by 100, by the distance from the hinder border of the tooth to the nearest point of the anterior bay. His results on the teeth of the Liakhof skull are given below, and with them the indices derived from the skull forming the type of *Equus niobrarensis*, the Alaskan skull here described, two skulls of *Equus grevyi*, and two of *Equus burchelli granti*. In each case the present writer has taken the measurements from the hinder end of the under inner pillar (hypocone).

INDICES SHOWING EXTENSION FORWARD OF PROTOCONE IN *Equus*.

Teeth	Liakhof horse	<i>E. niobrarensis</i> type	<i>E. niob. alaska</i> type	<i>E. grevyi</i> No. 163228	<i>E. grevyi</i> No. 163331	<i>E. bur. granti</i> No. 162951	<i>E. bur. granti</i> No. 161927
Pm. <sup>3</sup>	127.2	120	108.3	115.8	108	112.5	106.9
Pm. <sup>4</sup>	123.6	119.7	109.9	115.8	111.6	123.3	115
M. <sup>1</sup>	119.5	112.5	106.7	117.6	117.6	111.2	106.9
M. <sup>2</sup>	127.5	117.8	111.1	120.9	113.9	116.1	106.4

It will be seen from this table that the indices of the Liakhof skull stand above all the others here measured. It will be observed also that there is a considerable range in the cases of the two specimens of Grevy's zebra and in the two of Grant's zebra. Inasmuch as both the depth of the anterior bay and the extension forward of the protocone may vary independently of each other, it would probably be better to compare each with the length of the grinding surface or with its width.

While it must be admitted that the Liakhof skull resembles greatly that from Alaska, the writer is not prepared to say that they belong to the same species. It must be stated here also that, while Tscherski in his work calls the Liakhof horse *Equus caballus*, he (p. 341) expresses the opinion that in case the peculiarities of the skull should be found repeated in other specimens, this might justify the specific independence of the animal.



1



3



2

**EQUUS NIOBRARENSIS ALASKÆ**  
 1. Side view of skull. x 1. 2. Upper premolar and molar teeth. x 1. 3. Upper incisor teeth. x 1.







*EQUUS NIOBRARENSIS ALASKÆ* x 1

1. View of skull from above. 2. View of skull from below.



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# GREAT STONE MONUMENTS IN HISTORY AND GEOGRAPHY

BY

J. WALTER FEWKES



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# GREAT STONE MONUMENTS IN HISTORY AND GEOGRAPHY<sup>1</sup>

By J. WALTER FEWKES

## INTRODUCTION

A seemingly well defined phase of human culture history, attained independently in localities widely separated geographically, has been designated the megalithic. The dominant racial feeling, religious or cultural, was expressed in this epoch by great commemorative monuments constructed of stone and called "monoliths," or, when sculptured in life forms as representations of animals, men, and gods, they are termed colossi.

The close connection, in the mind of primitive man, of culture and religion is preserved in the Latin word *cultus*, or its English derivative, culture, the stimulus for which is desire for improved condition of life in thought and act or a striving for higher ideals, so well brought out in Mr. Matthew Arnold's scholarly essay, "Sweetness and Light." The megalithic epoch expresses objectively a consciousness of power and is largely correlated with religious feeling and the cult of the dead.

This phase in racial history culminated in the later Stone Age, and in some cases lasted long after the discovery of metals, echoes of it appearing sporadically even in the highest civilization. Many races appear not to have had a megalithic epoch in their history; in others the expression was individual, not racial; some peoples had not sufficiently advanced to have attained it, while others have progressed so far beyond this condition that its very existence is at present known only by monuments; the names and the races of the builders have passed out of memory, or are unrecorded.<sup>2</sup>

<sup>1</sup> Presidential address delivered before the Anthropological Society of Washington, February 20, 1912. This address was accompanied by stereopticon views, only a few of which are here reproduced as illustrations.

<sup>2</sup> Since the habit of erecting megalithic structures is of independent origin and not derivative, the age of monoliths varies among different races. While the dynasty in which many of the Egyptian obelisks were erected is known from the inscriptions they bear, no one has yet satisfactorily determined the antiquity of the unworked dolmens and menhirs, nor is it known whether they were erected contemporaneously with obelisks or earlier.



The able archeologist, Dr. Daniel Wilson, was one of the first to clearly recognize this epoch, as will appear in the following quotation from his article on Archæology in the *Encyclopædia Britannica* :

There appears to be a stage in the development of the human mind in its progress towards civilization when an unconscious aim at the expression of abstract power tends to beget an era of megalithic art. The huge cromlechs, monoliths, and circles still abounding in many centers of European civilization perpetuate the evidence of such a transitional stage among its prehistoric races. But it was in Egypt that an isolation, begot by the peculiar conditions of its unique physical geography, though also perhaps ascribable in part to certain ethnical characteristics of its people, permitted this megalithic art to mature into the highest perfection of which it is capable. There the rude unhewn monolith became the graceful obelisk, the cairn was transformed into the symmetrical pyramid, and the stone circles of Avebury and Stonehenge, or the megalithic labyrinths of Carnac in Brittany, developed into colonnaded avenues and temples, like those of Denderah and Edfu, or the colossal sphinx avenue of Luxor.

He refers elsewhere to it as follows :

There seems to be an epoch in the early history of man when what may be styled the megalithic era of art develops itself under the almost endless variety of circumstances. It is one of the most characteristic features pertaining to the development of human thought in the earliest stages of constructive skill.

It is an instructive study in religious or culture history to trace the distribution of megalithic monuments characteristic of this epoch, to compare the varieties of forms they assume in different localities and consider their purpose; but the vastness of the subject limits my consideration to one aspect, monoliths and colossi, rendering it necessary to pass over a large number, perhaps the majority, of megaliths.

Why do these monuments occur in certain geographical localities and not in others, and how are they to be interpreted by the student of human geography? What is the nature of the feeling they express?

The causes which have led one race and not another to develop a megalithic habit may be sought in certain psychical conditions difficult of interpretation, but the custom appears to have originated independently and spontaneously under different physical conditions. The erection of monoliths is not due to similarity of environment so much as to identity of thought;<sup>1</sup> the feeling originating subjectively rather than in response to surroundings. Westropp (" Prehistoric Phases ") writes:

It is now a generally accepted canon that there are common instincts implanted by nature in all the varieties of the human race, which lead mankind

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<sup>1</sup> A consciousness of power, always a source of personal and racial gratification, tends to express itself in huge monuments.

in certain climates and at a certain stage of civilization to do the same thing in the same way, or nearly so, even without teaching or previous communication with those who have done so before.

Mr. John Evans apparently had a similar idea and remarks:

The curious similarity observed in different parts of the world may possibly be due to some analogous development of thought and feeling rather than to any intimate connection between the races who erected them.

In much the same way Professor Westropp thus expresses himself in his work "Prehistoric Phases" (p. 122):

The weapons and instruments of stone which are found in the north of Europe, in Japan, in America, the South Sea Islands, and elsewhere, have, for the most part, such an extraordinary resemblance to one another in point of form, that one might almost suppose the whole of them to have been the production of the same maker. The reason for this is very obvious, namely, that their form is that which first and most naturally suggests itself to the human mind.

Mr. Dennis in a suggestive work,<sup>1</sup> speaking of those megalithic monuments called cromlechs, writes:

This form of sepulchre can hardly be indicative of any race in particular. The structure is so rude and simple that it might have suggested itself to any people and be naturally adopted in an early state of civilization. It is the very arrangement the child makes use of in building his house of cards. This simplicity accounts for the wide diffusion of such monuments over the Old World. . . . there is no necessity to seek for one particular race as the constructors of these monuments or even as the originators of the type.

The significance of megalithic monuments is correctly pointed out by Mr. Fergusson who writes:<sup>2</sup>

Honour to the dead and propitiation of the spirits of the departed seem to have been the two leading ideas that, both in the East and West gave rise to the erection of these hitherto mysterious structures which are found numerous scattered over the face of the Old World.

In somewhat the same vein are the words of Mr. John Stuart:

The remains of most ancient people attest that greater and more enduring labor and art have been expended on the construction of tombs for the dead than in abodes for the living.

Sir James Stimpson held somewhat the same belief:

There is no longer reason to doubt that the Egyptian pyramids are megalithic tombs of the dead.

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<sup>1</sup> Groge Dennis, *The cities and cemeteries of Etruria*. London, 1848, 3 ed., 1883.

<sup>2</sup> Fergusson, *Rude Stone Monuments*, p. 509.

A study of the megalithic epoch has its historical and its geographical sides; the historian being concerned with its appearance in time; the geographer with place. The anthropogeographer embracing both in his consideration asks the pertinent question: Why has this epoch occurred at a certain place at a certain sequence in culture history and not elsewhere at another time?

It is unnecessary to remind you that culture history is not limited to written records, and that concerted actions of races, whether recorded or not, constitute their history. Those inventions that have most profoundly influenced culture, like the discovery how to make fire, are more important in results than great battles that have brought about dynastic changes.

Monoliths, as expressions of a desire to perpetuate the memory of ancestors or to commemorate past events, are naturally found only where the race had arrived at a self consciousness of its own power. Their geographical distribution<sup>1</sup> over the earth's surface corresponds roughly with the awakening of that consciousness. The megalithic custom, therefore, has an independent origin among different people, and its prevalence among widely separated races by no means implies, much less proves, acculturation or contact. It is autochthonous and its origin, being mental, can be traced to what for a better name we call psychic influence.

The megalithic habit is necessarily dependent on the nature of convenient rock formations and other geological conditions.

It is self evident that except in so far as the production of megaliths is dependent on transportation of material used, the distribution of monoliths is largely geographical, correlated with that of stones suitable for their manufacture. Great plains or sandy deserts furnish scanty material for construction of monoliths, and if megaliths are used by people living in this environment the distribution of rivers and the direction of their flow, by which they were transported from a distance, must be given weight. Monumental structures are not to be expected in cold regions where the earth's surface is covered with snow or ice clad; while generally children of the deserts, they occur in forested regions, and are commonly found in those regions of the earth that show a long continued habitation by man. They are tropical and warm temperate zone structures and exotic elsewhere.

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<sup>1</sup> Evidences of great human antiquity are commonly found in regions where megaliths occur. It takes a long time to develop this habit or phase of thought, and monumental structures are not the product of a few years.

It will be well, at the very outset, to choose a few types of megalithic monuments for study and to eliminate certain huge single stones used in construction of cyclopean walls, although they also are the same mental expressions and have a close cultural affinity with colossi and monoliths; they may be passed by but not neglected.

For convenience, monoliths may be treated under the following headings: (1) natural stones of great size placed vertically by human means but showing no sign of having been artificially shaped; (2) monoliths carved or otherwise worked artificially generally bearing elaborate inscriptions; (3) colossi or cyclopean monolithic representations of real or imaginary beings.<sup>1</sup> Monoliths may be still further classified, according to their purpose, as erected in commemoration of events or persons, boundary stones, or connected with ceremonials, but in no classification that has yet been devised do we find a clear cut line of demarkation between different classes. Thus large stones commemorative of events or statues of kings easily develop into objects of reverence. It is interesting to note that colossal statues of so-called gods are often commemorative of deified heroes, and it is probable that the same feeling that leads civilized man to erect statues of those he honors also accounts for the existence of monoliths among men less highly developed culturally.

Natural monoliths or huge stones, unchanged by the hand of man, have been set up by all races, occurring with equal abundance in Europe, Asia, Africa, America, and the islands of the Pacific. They are found singly, or in groups, regularly or irregularly arranged, taking the forms of rectangles, circles, and other combinations.

#### OLD WORLD MEGALITHIC EPOCH

In certain regions of the earth's surface, as in France, England, the Mediterranean Islands, along the coast of northern Africa,<sup>2</sup> Syria, Egypt, and India, monoliths are more abundant than in regions situated in higher latitudes. They are not found very far from the historic zone of civilization. The similarity of these objects along both shores of the Mediterranean Sea and beyond the Pillars of Hercules has suggested to some students that they were erected at the

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<sup>1</sup> The discussion is limited to monolithic colossi for obvious reasons.

<sup>2</sup> A. Lissauer, *Archæologische und Anthropologische Studien über die Kabylen* (Zeit. f. Eth., Vol. 40, part 4, 1908. Berlin, 1908) gives figures and illustrations of dolmens, menhirs, and cromlechs from Tunis to Tangiers. A map locating the megaliths shows the distribution of different types. Translation in Smithsonian Report for 1911.

same time by the same race, but the constructors of monoliths have not necessarily a racial connection.

It is believed that the unworked monolith was used far back in human history for some religious purpose. While its erection as a commemorative object would seem to be secular and to have developed from the habit of throwing together a heap of stones to mark some event, a large stone has almost invariably acquired a religious meaning. Worship of stones is universal;<sup>1</sup> the Greeks early worshipped a shapeless stone, probably a meteorite, in Ephesus that was later replaced by a beautiful statue representing Diana. The Kaaba of Mecca, as is well known, antedates the Mohammedan era; the shrine of the Earth and Fire god of the Hopi Indians of Arizona is a log of petrified wood.<sup>2</sup>

The following interpretation of the structure of megaliths known as cromlechs has been suggested by Herr W. Pastor. They present three distinct regions: (1) a centrally placed altar; (2) one or more concentric circles<sup>3</sup> of stone surrounding this altar: (3) an entrance passing to the holy enclosure formed by rows of stones cutting the concentric circles at right angles.

Since monoliths from their very nature are commemorative they early became the media on which pictographs were incised, and there is an instructive connection between the origin of writing and the construction of monoliths. Man first inscribed his ideas on the face of cliffs, rocks, or boulders, and it is a significant fact that the races that have invented writing have likewise been foremost in erecting monoliths. The relation, however, is not necessarily one of cause and effect. On Easter Island, for instance, where great colossi in human form exist, we also find evidence of writing. The glyphs of the Central American stelæ are well known. The Egyptians who excelled all people in the grandeur of their megalithic monuments, have left the largest known corpus of hieroglyphic material. Irish

<sup>1</sup> My friend, Dr. I. M. Casanowicz, has called my attention to the fact that Cybele (*Magna deum Idæa*) "came from Phrygia to Rome in 204 B. C. and was solemnly installed on the Palatine under the form of a black aerolite."

<sup>2</sup> Very many instances of stone worship among American Indians might be mentioned; almost any strangely shaped stone is supposed to have magic powers.

<sup>3</sup> Professor Lockyer finds in these circles of megaliths evidences of sun worship; according to him the concentric lines of stones represent the course of the Sun god. To Mr. Arthur Evans "it seems a universal rule that the stone circle surrounds a central dolmen or stone cist containing the remains of the dead."

ograms and Scandinavian runes are well known, but no North American tribe erected a monolith or independently invented a system of writing. In the majority of cases the most perfect monoliths, like the obelisk and colossus, in the New World as well as the Old, bear hieroglyphics.<sup>1</sup>

We find at various places in the old and new continents monoliths arranged in alignment or rectangular or circular forms which were connected with solar or stellar ceremonies. These combinations bear various names, being known in the New World as Indian



FIG. 1.—Portion of Stonehenge, Wiltshire, England, from Lockyer.

enclosures, ball courts, or corrals; while in the Old World they are called dolmens, menhirs, and cromlechs.

Columns or pillars supporting roofs of buildings, which are so common in sacred architectural constructions, are regarded as monoliths related to those commemorative or religious forms we are considering.<sup>2</sup> In the same architectural category are huge stone blocks

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<sup>1</sup> The association of writing with monoliths is one aspect of a general truth, already mentioned, that the latter almost universally occur in localities where there are evidences of a great antiquity of man.

<sup>2</sup> This theory would consider the columns of Greek temples as morphologically upright stones surrounding a sacred enclosure, rather than homologues of wooden piles of archaic pile dwellings, as taught by Sarasin.



used in foundations or construction of buildings or monolithic roofs of tombs. The covering of the grave of Theodoric the Great at Ravenna, Italy, is a good example of this type of monolith, as are likewise the huge stones found in buildings in Japan, at Ostia near the mouth of the Tiber, in Peru, and elsewhere.<sup>1</sup>

At this point in a consideration of megalithic structures may be mentioned the almost universal duality of types of buildings among human races, or the deep-seated architectural distinction between sacred edifices and habitations. This difference is primarily due to dissimilarity in origin and use. The hut or habitation has, as a general thing, no resemblance to a primitive sacred edifice, nor does the home and temple develop along the same lines. One is transient, the other permanent; one disappears in a generation or two, the other remains unchanged; one is the product of individual labor, the other of combined racial work governed by religious ideals. Consequently little or nothing is known of the houses of the builders; we know only their great temples or religious structures.

As megalithic structures are religious in use it is natural to trace their origin to the same feeling that erected rude stone monuments or monoliths to tombs of the dead, rather than habitations of the living. Temples and shrines thus belong to a series apart from secular buildings. To them we owe the development of sacred architecture which is primarily a communal expression of religious feeling in the building art. The palace-temple contains rooms for the residences of priests, but still preserves the primary distinction between a habitation and a sacred edifice.

The best known of all megalithic monuments is the famous Stonehenge, in Wiltshire, England, the purpose of which has been variously

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<sup>1</sup> So far as size goes some of the circular disks with central holes, from Uap, one of the Caroline Islands, may be called monoliths. These stones have been figured and described by Mr. Wm. H. Furniss, 3d, who thus identifies these as stone coins: "This medium of exchange they call Fei and it consists of large, circular, stone wheels ranging in size from a foot in diameter to twelve feet, and having in the center a hole, varying in size with the diameter of the stone, wherein a pole may be inserted sufficiently strong to bear the weight and to facilitate transportation. These stone coins, if I may so call them, are not made on the island of Uap, but were originally quarried and shaped in the Pelao Islands, four hundred miles to the southward, and then brought to Uap by some venturesome navigators in canoes and on rafts, over seas by no means as pacific as the name implies." (University of Pennsylvania, Trans. Dept. Archæol. Free Museum of Science and Art, Vol. I, 1904-5, p. 53.)

interpreted by different authors. This monument consists of many monoliths and trilithons, some of which are more or less artificially worked, others natural, surrounded by rings of stone.

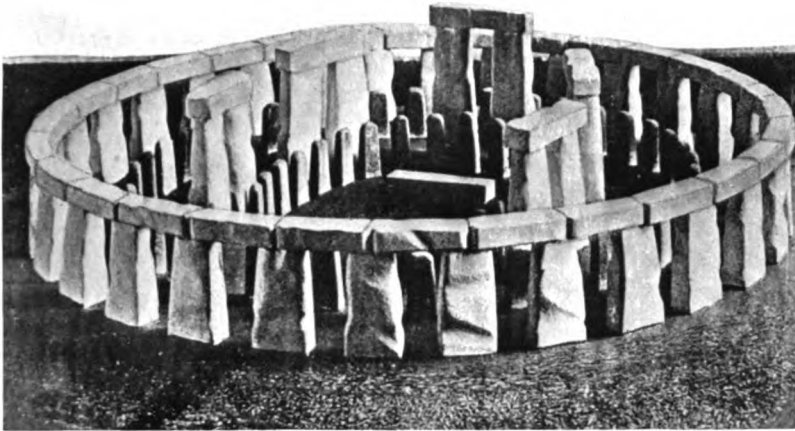


FIG. 2.—Stonehenge, Wiltshire, England (restored).



FIG. 3.—Stonehenge, Wiltshire, England, from Lubbock.

The stone circles of Avebury, measuring 1,200 feet across, were the largest and finest megalithic monuments in existence, “exceeding Stonehenge as a cathedral does a parish church.” Other stone circles occur at Stanton Drew in Somersetshire, in the Orkneys and other English islands.

Simpler forms, like "Kit's Coty House," one of the best known dolmens<sup>1</sup> in England, are reproduced almost in duplicate in Sweden, Holland, Denmark, Portugal, France, India, on the banks of the Jordan, in the deserts of Arabia, India, Syria, Mexico, and Peru.

The evidence available shows that rude undressed stones, like menhirs, dolmens, and cromlechs, are essentially sepulchral or memorial stones, but their wide distribution over the earth's surface precludes our limiting them to any one race of men. In some parts of



FIG. 4.—Talaya, Balearic Islands, from Cartailhac.

Europe they have been ascribed to the Druids, but the presence of dolmens<sup>2</sup> and cromlechs in lands where Druids never lived shows that this popular belief must be somewhat modified. In their distribution around the shores of the Mediterranean, Corsica, Sardinia, and the Balearic Islands, they seem to have followed certain laws which might

<sup>1</sup> Particularly fine table stones called talaya, occurring in the Balearic Islands, have been described by Cartailhac, *Monuments primitifs des isles Baleares*, Toulouse, 1892. The latest work on these talayas is by A. Bezzenberger, *Vorgeschichtliche Bauwerke der Balearen*, Zeit. für Ethnol., Berlin, 1907.

<sup>2</sup> Their names are Gaelic, but there is nothing to show that a cromlech or dolmen was ever constructed by the Druids for an altar.

lead us to refer these monoliths to a center of distribution, situated on the shore of the eastern Mediterranean, but this law can not account for the presence of similar monoliths of the New World or in eastern Asia or southern Africa.

Some of the dolmens now above ground were formerly buried and were superficially indicated by mounds or barrows.<sup>1</sup> But perhaps the religious character of menhirs, cromlechs and dolmens is best indicated by those buried in mounds:

The great Lanyon dolmen in Cornwall was uncovered about one hundred years ago by a farmer who supposed it to be a mere heap of earth which he thought might be usefully applied to farming purposes. By degrees, as the earth was carted away, the great stones began to appear and when operations were completed and all the soil had been cleared away the dolmen, much as it now exists, was disclosed containing in its interior a heap of broken urns and human bones.

The relation of megalith and mound is shown in the accompanying views (figs. 5, 6) of New Grange, Ireland, from a work on Irish antiquities by Vallancey, published near the close of the 18th century.

The geographical distribution of megalithic remains is almost parallel with that of stone buildings, which in turn are identical with caves, natural and artificial.

Mr. Baring Gould<sup>2</sup> describes and figures buried dolmens in south France upon which churches were constructed, the chamber of the dolmen serving as the crypt of the church, a perpetuation of the sacred character of a building used for religious purposes in prehistoric times before the introduction of Christianity. This fact is in evidence

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<sup>1</sup> Some of the dolmens may have always been aerial or never covered with soil forming a mound; others apparently were formerly buried, appearing on the surface as a barrow or mound.

<sup>2</sup> *Cliff Castles and Cave Dwellings of Europe*, London, 1911. According to Mr. Baring Gould (pp. 190-192) there is situated near Plouaret, in Cotes-du-Nord, a prehistoric dolmen under a tumulus on which is a chapel, the crypt of which is the subterranean chamber of the dolmen. The prehistoric monument in this example consists of two capstones of granite resting on vertical uprights. He likewise describes from Cangas-de-Ones near Oviedo, in north-west Spain, a chapel on top of a mound covering a dolmen. From the chamber of the dolmen that serves as the crypt to the church prehistoric copper and stone objects have been taken, the country people regarding the cavity of the dolmen as a saint's tomb, soil from which is regarded by them as possessing medicinal virtues. The cover or capstone of a dolmen near S. Germain-sur-Vienne is supported on pillars made in the 12th century, the original supports having been removed. It served as a cover of an altar made of stone and a chapel now destroyed was built about it—a transmission of the sacred use of the dolmen as an altar into Christian worship.

in its bearings on the former religious use of the megalithic monuments.

Windle,<sup>1</sup> in considering the use of monoliths, writes:

Such stones have been in other countries not merely memorials of some great deed or departed hero, but objects of worship, and the same was probably the case in this country.

Mr. Gomme, in an instructive work, "Survivals of Worship," shows how the reverence once attached to them persists in folk practices.

At the village of Holme situated on one of the moors of Dartmoor is a field of about two acres, the property of the parish and called Plog Field. In the center of this field stands a granite pillar (menhir) 6 feet or 7 feet high. On May mornings before daybreak the young men of the village used to assemble there and then proceed to the moor where they released a ram lamb, and after running it down brought it in triumph to the Plog Field, fastened it to the pillar, cut its throat and then roasted it whole.

The relation of megalithic chambers and burial tumuli is shown by a writer in the following quotation from the Edinburgh Review:

It may probably be assumed that the dolmen or cromlech was originally a stone cist in the center of a tumulus meant to contain either one or more bodies. This, afterwards, was expanded into a chamber for the accommodation of several. In the third stage it was furnished with a passage or avenue of entrance so as to be permanently accessible. In the fourth stage, the covering tumulus was dispensed with; but the last form most probably was when the cromlech was placed externally on the top of the mound as a mere ornament or simulated tomb, as we find in France and Algiers.

The evidence drawn from a study of the monoliths known as menhirs, dolmens, and cromlechs seems conclusive that they were connected with religious beliefs and always related in some way to the dead or mortuary ceremonials. In western Europe these stones have long since ceased to be used in religious rites, although survivals of former ceremonials persisting in peasant folk lore, are significant. We must look elsewhere in other lands where similar objects occur for light upon the meaning of monoliths. Asia and Africa furnish important aid in this study.

Herr Kremer in his accounts of the ancient cults of Arabia makes frequent allusions to natural stone worship, and in the village of Tarf there was worshipped a great irregular stone block identical with a

<sup>1</sup> B. C. A. Windle, *Life in Early Britain*. London, 1897. This author also writes: "The observation of Aristotle, to which Dr. Thurman calls attention, that the Iberians used to place as many obelisks around the tomb of the dead warrior as he had killed enemies perhaps gives a clue to the origin of this custom."

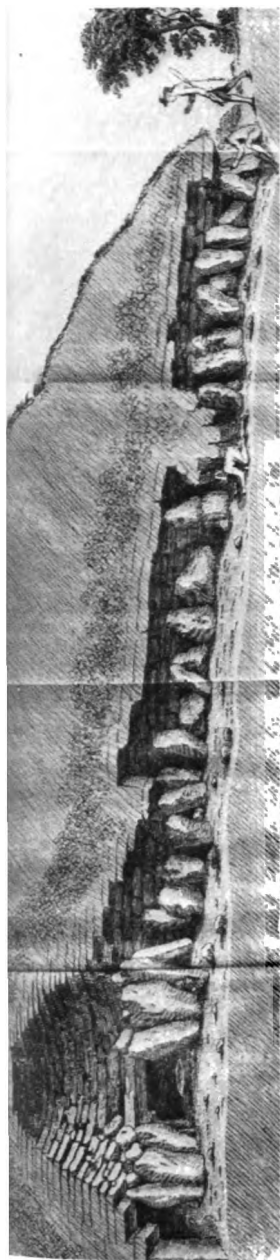


FIG. 5.—Lateral view, New Grange, Ireland (schematic) from Vallancey.

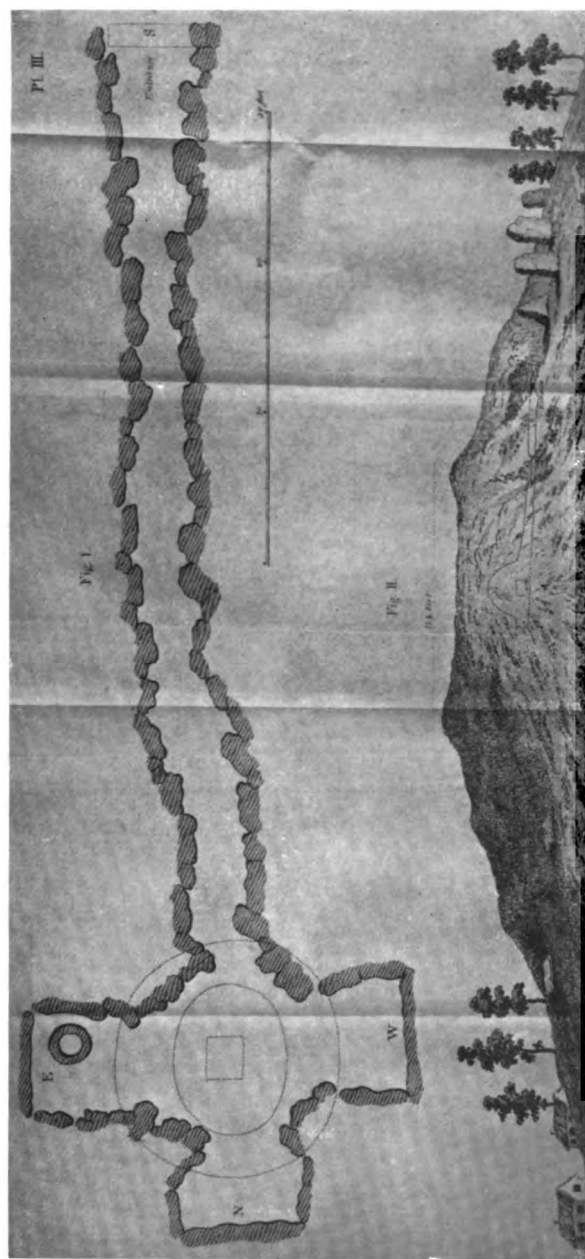


FIG. 6.—Ground plan and elevation of mound at New Grange, Ireland, from Vallancey.

goddess whom Herodotus called Urania. The Phenicians were very much given to the worship of stones called *baetylia*, and wherever the influence of this wide roving race of traders was exerted there these monoliths are found. They are scattered along routes of trade of this people and to a degree their distribution follows the same law as that of Greek colonization so ably pointed out by Professor Myers. Apparently the same paucity of these monuments is found on the coast of the Adriatic Sea, for the same reason that it has no Greek colonies. These *baetylia* are most abundant where Greek and Phenician settlements, especially the latter, are most numerous.

Certain districts of India, as the Neermul Jungle, are said to swarm with monoliths and megalithic monuments. In Berrary, alone, Dr.

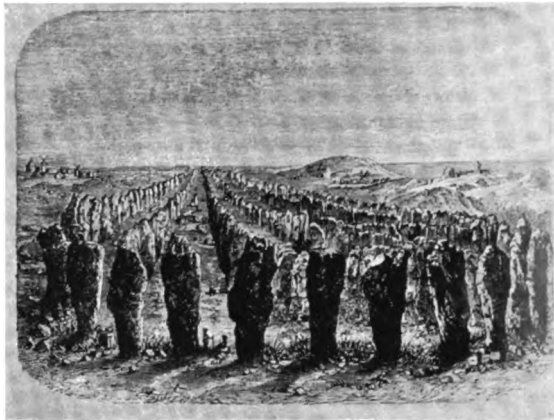


FIG. 7.—Carnac, Brittany, from Hunter-Duvar et alii.

Forbes Watson counted 2,129 megalithic monuments, and menhirs, cromlechs, and dolmens have been recorded in Sorapoor and Khasia; they also occur elsewhere among the hill tribes. The Todas in the Nilghery Hills have large stone circles similar to those of England, and in the Deccan, in India, villages are said to have circles of large stones sacred to Vetac. Col. Leslie records stone circles in Ceylon, and according to Palmer there are stone circles over 100 feet across near Mt. Sinai in Arabia, where Kohen mentions three large stone circles consisting of lofty trilithons 10 feet high, standing on raised foundations. Stone monuments occur in Morocco, Algiers, Tripoli, and along the whole coast of northern Africa; Lieutenant Oliver has compared the megalithic structures found in Madagascar, among the Hovas, with those of the Channel Islands.



The upright stones of some of the East Indian dolmens in the Deccan are, according to Capt. Meadows Taylor,<sup>1</sup> perforated and used by the natives for various purposes one of which is to facilitate the passage of food to the manes of the dead.

Similar "holed-stones," according to Mr. W. G. Wood-Martin,<sup>2</sup> which "may, in most instances, be regarded as pillar-stones," are found in Ireland: they occur in Scotland, England, and France, and from thence can be traced to India. It is stated that in the last mentioned country these perforated stones are "used by devotees, as a means of attaining forgiveness of sins, or for spiritual regeneration. If the hole is large enough, the suppliant creeps through, but if it is small the hand alone is passed through."

While some of the Irish "holed-stones" are unworked monoliths perforated, belonging to pagan times and worship, the early Christian missionaries, in order "to divert the religious feeling pertaining to them into Christian channels, caused them to be cut in the shape of crosses, the hole being reduced to the size of the finger." These so-called "secondary holed-stones" are also known in Ireland as "prayer-stones" and still appeal to the imagination of the modern peasants, who suppose they possess magic powers. Irish country women resort to them to pray for children; marriages are performed near them, the betrothed pair clasp hands through them; while children by creeping through them are supposed to be cured of certain



FIG. 8.—Holed-Stone, India, from Strand Magazine.

<sup>1</sup> Capt. Meadows Taylor, *Trans. Roy. Hist. Acad.*, Vol. 24, p. 329.

<sup>2</sup> W. G. Wood-Martin, *Traces of the Elder Faiths of Ireland*, 2 vols., London, 1902.

ailments. The ancient varieties sometimes take the form of stone rings which Mr. Wood-Martin labels, "enormous wedding rings." Circular "secondary holed-stones" known to have been "lying for ages in the church yard of Kirk Braddan in the Isle of Man," remain, according to Mr. Wood-Martin, "ready for use by any bewildered bridegroom who may have forgotten to bring the ring for his bride."

It is a far cry from the Manx stone rings to the stone "collars" of the aborigines of Porto Rico, but both may have been connected with rites of similar intention.<sup>1</sup>



FIG. 9.—Holed-Stone, Ireland, from Wood-Martin (Welsh's Irish Views).

For obvious reasons I shall not attempt to consider the phallic side of the study of monoliths, but my presentation would be incomplete if it were not mentioned. It is self evident that the mystery of the origin of life made a profound impression on the mind of the primitive as well as on the most highly educated mind.

<sup>1</sup> In a short article in the *American Anthropologist* (Vol. 13, No. 3, 1911) Mr. Herbert Janvrin Browne interprets the Porto Rican slender stone collars as representing the female sex organ used in auto-suggestion at birth. He also identifies on them the different anatomical parts. It is not unlikely that these enigmatical objects may be connected with germination ceremonies, but how far we can go in comparing them in detail with the organ mentioned is not wholly satisfactorily determined.

Similar perforated stones, called in Germany "helfensteins," are interpreted as connected with a future life in the sepulture they enclose. Perforated slabs of rock of unknown significance occur in pueblo graves near ruins along the Little Colorado in Arizona.

Dolmens have been found in Korea, and others constructed of unhewn stones have been discovered in Kiusia and in the south part of the island Yeso. Some of these Japanese dolmens are two chambered and have stone floors and passageways.

Palgrave mentions in an account of his travels that he saw in the Kaseem, central Arabia, enormous stone boulders placed perpendicularly and he also records having observed others arranged in curves as if they once formed a part of an immense circle, differing but little from Stonehenge or other European dolmens and cromlechs.

The artificial monolith includes all single stone monuments of size worked by human hands, from a rude hewn slab set on end to a finely carved obelisk inscribed with hieroglyphs. Some of these stones are enormous in size, but how they were cut from the quarries and transported long distances are facts difficult to explain with our limited knowledge even of the Egyptians, whose every art and craft is illustrated on the walls of tombs and temples by picture writing. Many of these large stones were apparently moved without the use of machinery, yet we find this accomplished without leaving any traces of roads or highways. To indicate the magnitude of the work of transporting these great stones consider the amount of labor in transporting the monolithic pillars of the Treasury building in Washington, which are among the largest single stone blocks in the United States, and have been calculated to weigh 38 tons; some of the Egyptian obelisks weigh 300 tons, or nearly eight times as much.<sup>1</sup>

The columns or pillars of the Cathedral<sup>2</sup> of St. John the Divine in New York will be even larger than the monoliths of the Treasury building.

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<sup>1</sup> The monument of Emperor Alexander I, standing in front of the winter palace in St. Petersburg, probably the most remarkable monument of artificial monolith in existence, is a cylindrical pillar of one solid piece of granite 78 feet high and 12 feet in diameter.

<sup>2</sup> Granite monoliths are being quarried at Vinal Haven, Maine, for the cathedral being built at Morningside Park, New York. Thirty-two of these columns are required to be 54 feet long and 6 feet in diameter, each weighing 160 tons, or two-thirds as much as Cleopatra's Needle in Central Park. For dressing and polishing these granite columns they are mounted in a giant lathe and revolved so as to bring their exterior surface first against cutting tools and afterward on polishing materials. This lathe is 86 feet long and weighs 135 tons, and the rough stone which it reduces to dimension, weighs at first as much as

Prof. G. P. Merrill, Curator of Geology, U. S. National Museum, has kindly sent me the following data on large stones lately quarried:

Authority	Quarry	Destination	Size	Weight.	Kind of Stone
Stone, Dec. 1892, p. 60	Stony Cr., Conn.	West Point, N. Y.	41'x6'x6"	100 tons	Branford Red Granite
Stone, Mar. 1902	Hallowell, Me.	Hall of Records, N.Y.	36'10"x4'10"	.....	Granite
.....	Badger Bros Quincy, Mass.	.....	72" diam.	110 tons	.....
.....	Barre, Vt.	Mausoleum Vice-Pres. G. A. Hobart	34'	43 tons	Granite
.....	J. J. and F. P. Treanor, Hastings-on-the-Hudson, N. Y.	Stoop, Huntington Mansion, 5th ave. and 57th st., N. Y.	22'x15'x18"	24 tons	.....

Several of the obelisks quarried and moved by the Egyptians were double the size of any of these and weighed several times as much:

The estimated height of the Lateran obelisk is 105 feet 6 inches and its weight 510 tons; Cleopatra's Needle in New York is 69 feet 6 inches high and weighs 224 tons. The obelisk still in the quarry at Syene is 95 feet long and it is estimated to weigh 770 tons, which may be a greater weight than the Egyptians could move.

The monolith has a religious significance in Arabia and is used to designate a place of prayer in some parts of Asia Minor. The present distribution of these monoliths marks the distribution of that pagan worship or abomination the Israelites repeatedly tried to root out but without success.<sup>1</sup> These "high places of worship" formerly found

310 tons. This lathe was designed and patented by engineers of Boston, and was constructed in Philadelphia. (*American Geologist*, Vol. 27, No. 1, January, 1901, p. 66.)

<sup>1</sup> Whether or not we accept the theory that the church spire and minaret is the surviving homologue of the ancient obelisks marking places of prayer, the absence of steeples in synagogues is often quoted as a protest against these indications of heathen worship.

Although the Israelites were commanded not to set up an image of stone (eben maskith) they often used stones for commemoration, as when Joshua erected 12 stones in Gilgad after crossing the Jordan.

everywhere among the Moabites, Canaanites, Edomites, and Samaritans are still to be seen in the Syrian and Arabian mountains, where they are marked with obelisks cut out of solid rock, photographs of which are shown by Libbey and Hoskins<sup>1</sup> in their account of the ruin of Petra.

It is instructive to note how universally ancient megaliths have come to be associated with germinative rites, which among primitive man are universal. In Brittany and elsewhere in France, Sabillot has found in the folk lore of the country people many large boulders where germinative rites are still performed. The same association exists

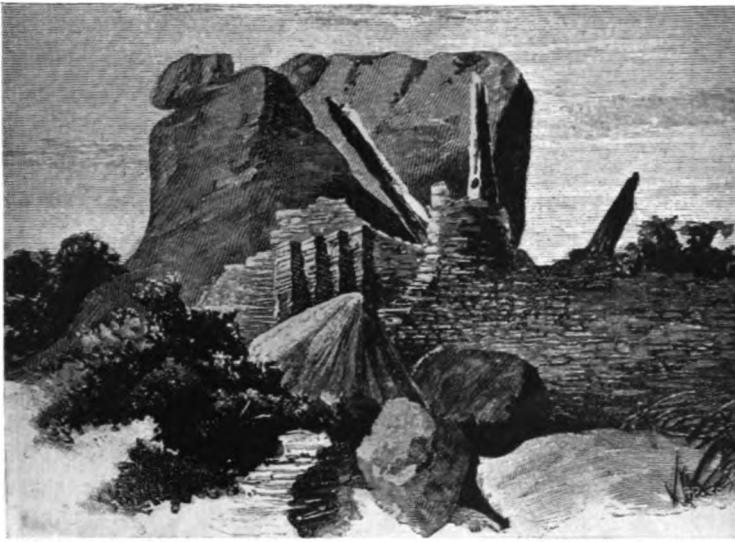


FIG. 10.—Platform monoliths, Zimbabwe, Africa, from Bent.

wherever monoliths occur. The obelisk or stone pillar of Begig in the Fayum is resorted to by Egyptian women who desire children, and the god of germs at Hopi is a log of petrified wood; survivals from different geographical locations which are instructive as showing the connection of these large stones with earth goddess worship.

The monoliths found in the great ruins of Mashonaland, in South Africa, recall in general forms the menhirs of Brittany, being for the most part tall, rude monoliths alternating with small round masonry towers arranged on platforms, reminding one of the stone colossi and their bases at Easter Island.

<sup>1</sup> William Libbey and Franklin Evans Hoskins, *The Jordan Valley and Petra*. New York, Putnam and Sons, 1905.

At the great ruin Zimbabwe, in South Africa, there are huge boulders about 50 feet high; immediately below the highest is a curious little plateau adorned by huge monoliths and soapstone pedestals supporting gigantic stone birds, the tallest of which stood 5 feet 4 inches in height. Several of these monoliths are decorated with life figures, one of which,  $11\frac{1}{2}$  feet high, is made of soapstone and adorned with geometrical patterns. In Bent's account<sup>1</sup> of this ruin occurs the following forcible description:

Such is the great fortress of Zimbabwe, the most mysterious and complex structure that it has ever been my fate to look upon. Vainly one tries to realize what it must have been like in the days before ruin fell upon it, with its tortuous and well-guarded approaches, its walls bristling with monoliths and



FIG. 11.—Stone birds, Zimbabwe, Africa, from Bent.

round towers, its temple decorated with tall, wierd-looking birds, its huge decorated bowls, and in the innermost recesses its busy gold-producing furnace. What was this life like? Why did the inhabitants so carefully guard themselves against attack? A thousand questions occur to one which one longs in vain to answer. The only parallel sensation that I have had was when viewing the long avenues of menhirs near Carnac, in Brittany, a sensation at once fascinating and vexatious, for one feels the utter hopelessness of knowing all one would wish on the subject. When taken alone this fortress is sufficiently a marvel; but when taken together with the large circular building below, the numerous ruins scattered around, the other ruins of a like nature at a distance, one cannot fail to recognize the vastness and power of this ancient race, their great constructive ingenuity and strategic skill.

Although we have no positive evidence that the South African obelisks are religious, the probability is that these monoliths illustrate

<sup>1</sup> J. Theodore Bent, *The Ruined Cities of Mashonaland*. London, 1892, p. 112.

the same law as similar structures found in Asia, Europe, America, and Polynesia. They are religious in nature or connected with worship and the cult of the dead.

### OBELISKS

The most finished type of monolith is the obelisk,<sup>1</sup> a stone structure best represented in the valley of the Nile and adjacent territory. In architectural proportions the Egyptian obelisk is a perfect monolith. Although from the early times transported by conquerors

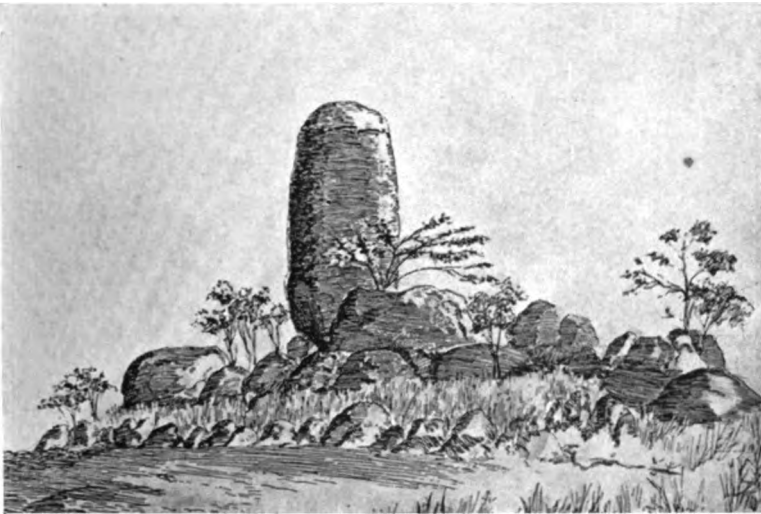


FIG. 12.—Monolith, Zimbabwe, Africa, from Bent.

of Egypt to different localities in Europe and adopted throughout the world as a commemorative or mortuary monument, the obelisk in its present form originated in a narrow geographical area skirting the Nile, in northeastern Africa.

Hardly a civilized country can be mentioned where imitations of Egyptian obelisks are not found. Essentially Egyptian in origin the obelisk was copied by both Greeks and Romans, especially the latter,

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<sup>1</sup> Egyptian Obelisks by Henry H. Goringe, New York, 1882. This monograph contains an exhaustive account of all known obelisks and a special description, profusely illustrated, of the removal of Cleopatra's Needle from Alexandria to New York; also Erasmus Wilson, Cleopatra's Needle and Egyptian Obelisks, London.

and its beauty <sup>1</sup> has been admired from earliest times. Good examples are found in Italy, England, the United States, France, Germany, and Constantinople; it has been stated by an acute student of the subject that at present there are more obelisks above ground in Rome than there are in Egypt,<sup>2</sup> their native land.

The purest type of obelisk, like that of Heliopolis, is a monolith tapering from base to apex, its height being about 10 times the length of one side of the base. In true obelisks all four faces are plain surfaces equal in width, although sometimes as observed by Verninac at



FIG. 13.—Obelisk, Heliopolis, Egypt.

Karnak there is a marked entasis or convexity similar to the curves in pediments of temples. When obelisks bear hieroglyphics they are regularly arranged in three rows reading from above downwards, the oldest vertical row being always in the middle.

The original inscriptions on some obelisks have been erased and new ones added, a method adopted by some rulers to express their consummate egotism.

<sup>1</sup> The obelisk has the three essential qualities indispensable in architecture as pointed out centuries ago by Vitruvius. It has *firmitas*, *utilitas*, and *venustas*—stability, utility, beauty.

<sup>2</sup> The largest number of obelisks found in one place in Egypt was 10 or more, some in fragments (Ebers says 12; Fergusson 13) at San in the Delta, the Zoan of the Bible (Brugsch's Egypt).



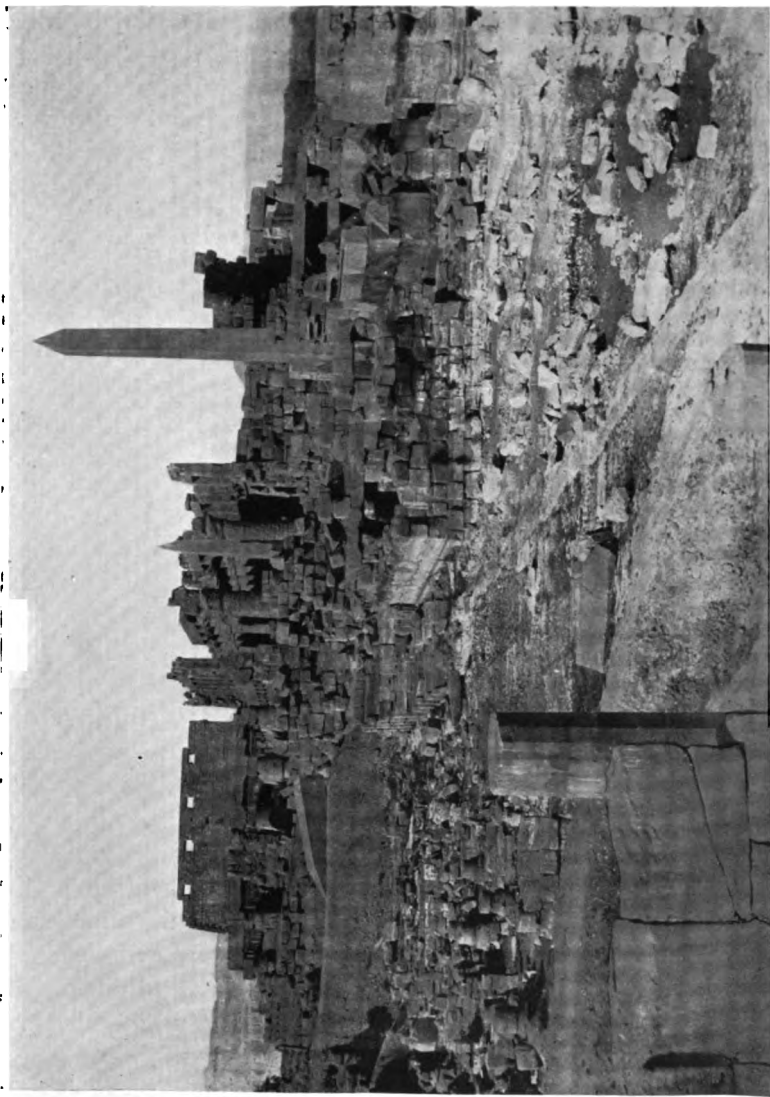


FIG. 14.—Temple and obelisk, Karnac, Egypt, photograph from Lekejan.

The various Egyptian obelisks not only vary slightly in proportions but also in decorations: some have pictures and inscriptions, others not. There is a variety in mounting; thus, the obelisk of the Piazza del Minerva in Rome and one at Catania in Sicily are carried on the backs of stone elephants. Supporting the corners of Cleopatra's Needle now in Central Park, New York, were bronze props representing crabs, which probably belonged to a later cult and were placed under this monolith when it was first moved and set upright in Alexandria.

Egyptian obelisks, as those of Karnac (Thebes), commonly stood in pairs before the gates of the temples and were made of hard stone obtained from quarries at Syene, from which fact the word syenite has come to designate this geological formation. They commemorate the deeds of rulers whose cartouches they bear, accompanied by invocations and grandiloquent references to the mighty deeds of the builders, or subsequent rulers.

The prostrate obeliscoid column of Begilg near Crocodilopolis, in the fertile valley of Fayûm, differs in the shape of its shaft and form of the apex from the others. Its sides are unequal and bear representations of beings<sup>1</sup> formerly worshipped. Its top is rounded, deeply grooved across the middle, and the sides are of unequal breadth. From an inscription on the narrow sides, as translated by M. Chabas, and as interpreted by the practices of native women about its fallen fragments, one is led to regard this obelisk as somewhat different from the majority of commemorative monuments. It is still regarded in the same light as the Phenician monoliths known as baetylia that are found on both shores of the Mediterranean from Asia Minor to Spain and Morocco.

Many theories have been framed to explain how these obelisks were quarried. A large specimen still remaining in place in the quarries at Syene is attached to the rock by one side, the other three sides having been fashioned into shape. It is supposed by some authorities that the form of the obelisk was first marked out on the surface by cutting a groove, and that the rock was cracked by first building fire on it, after which the ashes were swept away and water poured into the groove—a method still used at the present day by the East Indians. Other authorities have supposed that holes were made at intervals and a series of wedges was placed in these holes

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<sup>1</sup> The upper part is occupied by 5 vignettes representing the king Usertesen I, before 10 pairs of divinities, 5 on the right and 5 on the left.

and thus the stone was cracked off.<sup>1</sup> Having been quarried the obelisk was dressed and inscribed, after which it was moved to its future home. The means by which it was transported on rafts are known, but how the great weight was set on end after the obelisk had been brought to its future site is as yet not clear.

It would seem that the meaning of the Egyptian obelisks would be revealed by the inscriptions they bear on their sides. While this might be expected, unfortunately there is some lack of uniformity in the translation of those inscriptions, although all agree they contain arrays of grandiloquent titles and exalted references to attributes of the Pharaohs, indicating that they serve as memorials and were erected in commemoration<sup>2</sup> of rulers or events.

It is instructive for comparisons to pass to a consideration of commemorative objects like Alaskan totem-poles made of wood and those of New Zealand, where the same idea has been executed in both wood and stone. Lieutenant Meade, in an interesting work entitled "A Ride through New Zealand," describes a trilithon consisting of two perpendicular blocks of stone about 25-30 feet high supporting a horizontal one about half as long again. In the center of the latter

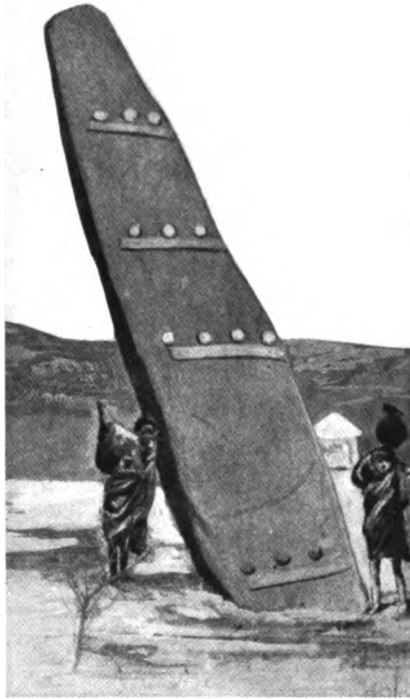


FIG. 15.—Monolith, Abyssinia, from Bent.

<sup>1</sup> The great Seringapatam obelisk erected by Hindoos in memory of Josiah Webbe, in 1805 was split off with iron wedges as described by Col. Wilks (Edin. Philos. Trans., Vol. 9).

<sup>2</sup> Pompey's Pillar, a shaft 88 feet 6 inches, according to an inscription was erected at Alexandria in Egypt in honor of the Emperor Diocletian. Its monolith measures 69 feet.

is a circular hollow or basin that the natives call the "kava bowl" of the gods or giants. The New Zealand totem-pole like that of our Northwest Coast was commonly carved in wood, but the same idea was expressed here as in other parts of Polynesia by great stones often uncut.

As we depart from the Nile, the home of the obelisk, southward into Abyssinia, we find representations of the obelisk of somewhat different forms and probably of different development. The main difference outside of the form appears to be the absence of inscriptions and a departure from the square section with equal faces.

The best Abyssinian obelisks would seem to represent sacred buildings, or sun houses consecrated to Baal, being connected with sabeism or sun-worship, a pagan cult that antedated the introduction of Christianity into Abyssinia, but which has left in that country several architectural survivals, among which may be mentioned circular churches with doorways at the cardinal points, and ceremonial rites as dances before the church altars.

It is almost impossible, indeed not necessary, to enumerate or describe all the monoliths of Abyssinia. The type is a characteristic one. Bent<sup>1</sup> estimates that there are 50 of these stones standing in the holy city, Aksum, alone, and Bruce says of the Aksum pillar stones:

In one square there are 40 of these obelisks, none of which have any hieroglyphs. One large specimen is still standing, but there are two others still larger that have been broken in falling. These obelisks are constructed of one piece of granite, and on the top of that which is standing there is a decoration somewhat Greek in appearance, that is exceedingly well carved. Below this apical ornamentation there is carved on the surface of the stone a door-bolt and lock, as if to represent an entrance into a rear room. The form of the lock and bolt resemble those used in Egypt and Palestine at the present day.

One instructive fact about the Aksum obelisks is that they present all varieties of form, from the rude unhewn stone to a highly finished obelisk with polished surface. The simplest form is a monolith set on end, and an intermediate stage of the series is represented by a squared natural rock with several notches on the corners or holes cut in the angles or on the faces to indicate floors or beams. A still more complicated form has four bands and accompanying circles supposed to represent the end of rafters cut in relief, and the most highly real-

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<sup>1</sup> J. Theodore Bent. *The Sacred City of the Ethiopians*, London, 1893.

istic represents the wall of a many-storied house, each having a sham door cut on the face of the obelisk, and in one instance with lock and bolt carved in relief.<sup>1</sup> Instead of having a pyramidion on top, as in the Egyptian obelisk, we find some of the Abyssinian obelisks tipped with a round projection with flat front and rear faces on the rim of which are still visible the holes for pegs by which a metallic disk, like those

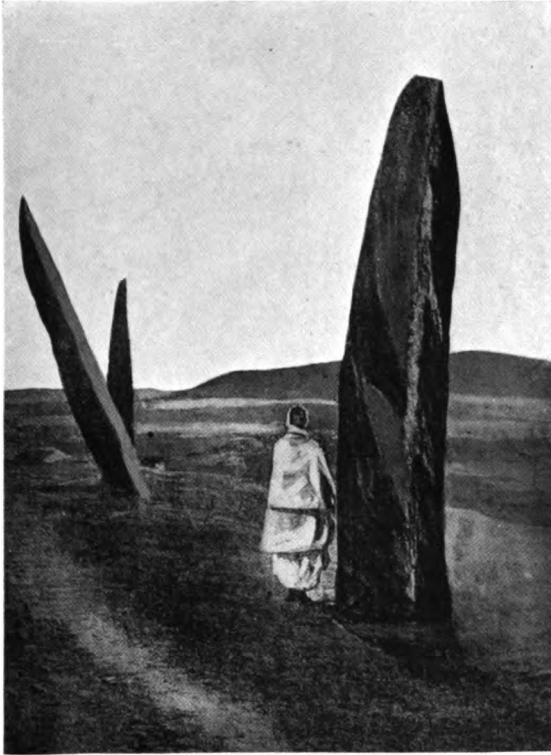


FIG. 16.—Monolith, Abyssinia, from Bent.

used in sabeism or sun-worship, was riveted. Bent finds at their bases remains of benches or tables on which he supposes sacrifices were formerly made in further support of the theory that these obelisks were devoted to the solar cult.

The monoliths of Russia, commonly called babas, or old women, grannies, may be classified as colossi and are probably of Mongol

<sup>1</sup>The obelisk in this example represents symbolically the habitation, the temple proper, or adytum, Beth-el, or House of God.

origin, being found from Mongolia to the banks of the Danube. They represent a connecting link between the statue menhirs or engraved dolmens of Aveyron, south France, the "steinfiguren" of Germany and the colossi of China, to all of which they are akin. They show that monoliths and colossi are the same in intent, and that the basal

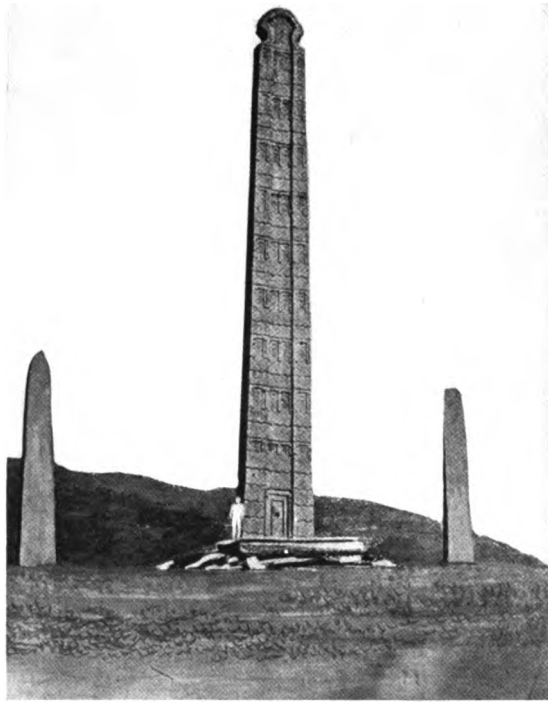


FIG. 17.—Monolith, Aksum, Abyssinia, from Bent.

principle of both is ancestor worship or the almost universal cult of the dead.

The latest historical and comparative study of these rude statues has been published by Joseph Castagné,<sup>1</sup> who has figured not only the babas or "grannies" of the steppes of Russia, but also a few similar images from Mongolia. Some of the babas of Orenburg preserved in the museum of that place are of considerable size, one being

<sup>1</sup> Joseph Castagné, *Bull. et Mem. de la Soc. d'Anthropologie*, No. 45, 1910.

mentioned as 10 feet in height. These babas are almost always found associated with burial tumuli, and are interpreted by Castagné as examples of the Roman custom of carrying wax masks of the deceased, or images of the defunct, their presence being survivals of the



FIG. 18.—Babas, grannies, Siberia, from Castagné.

cultus of the dead that had a real and serious meaning to primitive man.

#### COLOSSI

The highest expression of the megalithic art appears in great single stones carved into life forms known as colossi, of which the statues of Memnon are good examples. In these monoliths man attempted to

express his ideas of the greatness of his gods<sup>1</sup> or ancestors by the mammoth size of his idols.

We detect very clearly in the colossus the influences of geographical environment. They can be traced to a sedentary life, for a wandering people is not one that produces great sculptures. The dependence of the sculptor on available rock formation has long been recognized, for the production of a colossus of great size is impossible unless a certain kind of rock is available for that purpose. Colossi were made in the most advanced stage of the megalithic epoch and are abundant in both the old and new worlds.<sup>2</sup>

With exception of the sculptured menhirs, "steinfiguren," and babas, European colossi are small and inconspicuous. Monolithic colossal statues are not characteristic of ancient Greek, Etruscan, or Roman art in Europe, but occur in Asia,<sup>3</sup> northern Africa, Central America, and Polynesia.

We find some of the largest known colossi in Egypt where the megalithic age reached its highest development. The great sphynx at Ghizeh, the statue of Rameses II<sup>4</sup> and the enormous seated figures of the vocal Memnon, at Thebes, one of which is still a monolith, attest the barbaric power of the ancient Egyptians in this line of expression.

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<sup>1</sup> The area immediately surrounding the colossus is generally without roof, open to the sky—a characteristic feature of various forms of monoliths. The development of the enclosure where the idol stands into a temple led to a diminution in size of the colossus and a predominance of accessories. The idol being a symbol, the shrine or temple is symbolically the habitation of the god, but the main structures of the more complicated temples are elaborations of entrances and porticoes. Very diverse structures are called temples; the Yucatec sacrificial pyramid has little in common with the palace temples of Egypt and Assyria. Some of the Abyssinian obelisks have the house, as well as the disk, of the sun (Baal) upon it.

<sup>2</sup> In modern times we find allegorical figures, as the statute of Liberty at the entrance to New York harbor, that of Walhalla at Ratisbon, Bavaria, or the statue of Ariovistus, Germany, taking a colossal form. While the religious feeling is absent the commemorative element still survives, and is expressed in these and many other sporadic instances that might be mentioned.

<sup>3</sup> The terrace on which the temple (of Baalbec) stands is formed of stones of enormous magnitude; at the northwest angle are three stones, two of which are 60 feet, and the third 62 feet 9 inches in length. Hodder M. Westropp, *Handbook of Archaeology*, 1867.

<sup>4</sup> This stupendous statue now in fragments measured 22 feet 4 inches across the shoulders. Sir G. Wilkinson estimated that the whole mass entire weighed 887 tons.



The Babylonians and other ancients of the Euphrates valley were not inferior to the Egyptians in the production of enormous colossi, while the monolithic figures of Buddha scattered through India, Ceylon, Java, China, and elsewhere express the same feeling of enormous or ponderous power controlling the mind of a people dominated by a like consciousness.

In the buried cities of Ceylon there are many monoliths and colossi of Buddhas. The interior of the first temple of Dambulla contains



FIG. 19.—Great sphynx. Ghizeh, Egypt.

“the gigantic recumbent figure of Buddha, which together with the pillow and couch on which it rests, is cut out of the solid rock, and measures 47 feet in length.”<sup>1</sup> “The reclining figure of Buddha,” says Burrows in his description of Gal Vihara (rock temple) of Ceylon, “is by far the finest of the three. It measures 46 feet in length and has suffered little from the ravages of time.”

The colossi of China are best illustrated by the stone figures lining the road or dromos to the tombs of the Ming dynasty, about 40 miles north of Pekin, recalling the avenue of colossal sphinxes in Egypt. These huge images take the forms of men, griffins, elephants, camels,

<sup>1</sup> S. M. Burrows, *The Buried Cities of Ceylon*. Colombo, 1905.

and turtles, 32 in number, arranged in pairs ; one of the latter having an obelisk on its carapace reminds one of the elephant bearing an obelisk now in the Piazza del Minerva at Rome, and can be traced directly to Mongol influences, although in southern China where it is not as strong, giant images of Buddhas are frequently encountered.



FIG. 20.—Elephant colossus, Ming Tombs, China, photograph from F. B. Wright.

Historical monoliths like the Nestorian tablet of China set up in 781 A. D., or that erected by the Japanese in commemoration of the visit of the U. S. squadron to Japan under Commodore Perry, the Tomb of Midas and other massive rocks bearing inscriptions claim attention in our studies of the megaliths.

Boundary stones are repeatedly mentioned in Biblical writings. Both the Romans and Chinese erected stone pillars commemorative of battles, or memorials of famous emperors or generals.

The consideration of the great monoliths of the Pacific islands naturally lead us to the architectural wonders of Java, or to the great temples which arose in that island under Hindoo influences. In the



FIG. 21.—Elephant colossus, Ming Tombs, China, photograph from F. B. Wright.

silent jungles of this island stand the massive ruin of Chandi-Sewa, the "thousand temples," adorned with figures constructed of solid stone. Some of these ruins, as that of Chandi-Kali-Bening, surpass in size those in India itself and the magnitude of the great temple of Boroboda with its triple circle of towers compares favorably with the temples of Luxor and Karnac. The human labor necessary to

construct these sculptured hill temples of Java is almost incomprehensible. No other people have excelled the builders of these tremendous temples in their constructive skill and power of work.

It would be quite impossible to embrace in a few remarks any adequate account of the many colossi found in these Javanese temples, nor will a few examples, however fitly chosen, aid in your appreciation of them. I cannot in such a dilemma do better than refer you to the writings of Raffle and the magnificent plates of the temple of Boro-Bodo (Bara-Budur) published by the Minister of the colonies



FIG. 22.—Camel colossus, Ming Tombs, China, photograph from F. B. Wright.

of the Netherlands. Here we find massive megalithic architecture in all its grandeur, relieved with a profusion of detail, decorated with an artistic embellishment nowhere else duplicated in the megalithic age. These Javanese temples, as pointed out by W. H. Holmes, suggest the great prehistoric terraced sacred buildings of Central America,<sup>1</sup> and yet they are so characteristic of East Indian art that they

<sup>1</sup> A general view and ground plan of Boro-Boda (Bara-Budur), a typical example of these Javanese temples, shows a rectangular terraced structure with niches for sitting figures, like Papantla in Mexico, the whole covered by a cupola 52 feet in diameter surrounded by smaller cupolas. Like the topes or dagobas of Ceylon this building was for the enshrinement of relics rather than a temple in the Greek or Egyptian sense of the term.

stand out as a distinct architectural type. The mind of man was in both instances under the influence of an identical thought, environment furnishing different materials for the expression of that thought.



FIG. 23.—Colossus of soldier, Ming Tombs, China, photograph from F. B. Wright.

The existence of colossi on Easter Island, one of the most isolated islands of the Pacific Ocean, so far from all other monumental works of magnitude, is one of the archeological enigmas. Here and there on Pacific islands there are stones that may be called monoliths, but the images of Easter Island surpass them all in size and importance.

The latter are thus described in a report on a visit to this island in 1876 by Paymaster William J. Thomson,<sup>1</sup> U. S. Navy:

In order to form an estimate of the magnitude of the work performed by the image-makers, every one on the island was carefully counted, and the list shows

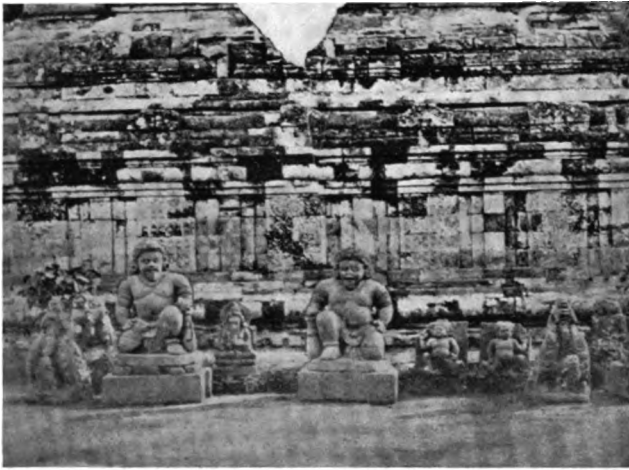


FIG. 24.—Brambanan temple façade, Java.



FIG. 25.—Boro-Bodo temple façade, Java.

a total of 555 images. . . . Of this number 40 are standing inside of the crater . . . . The largest image is in one of the workshops in an unfinished state and measures 70 feet in length; the smallest was found in one of the caves and is a

<sup>1</sup> Te Pito Te Henua, or Easter Island, by Paymaster William J. Thomson, U. S. N., Report U. S. National Museum for 1889, p. 497.

little short of 3 feet in length. One of the largest images that has been in position lies near the platform which is ornamented, near Ovahe; it is 32 feet long and weighs 50 tons. . . .

The images were designed as effigies of distinguished persons and intended as monuments to perpetuate their memory. They were never regarded as idols, and were not venerated or worshipped in any manner. . . .

The work of carving the image into shape and detaching it from the rock of which it was a part, did not consume a great deal of time, but the chief difficulty was, in the absence of mechanical contrivances to launch it safely down the slope of the mountain and transport it to a distant point. It was lowered to the plain by a system of chocks and wedges, and the rest was a dead drag accomplished by main strength. A roadway was constructed over which the images



FIG. 26.—Monoliths and images (fallen) Easter Island, from Thomson.

were dragged by means of ropes made of indigenous hemp, and sea-weed and grass made excellent lubricants. The platforms were all built with sloping terraces in the rear, and up this incline a temporary road-way was constructed of a suitable height, upon which the statue could be rolled until the base was over the proper resting place. The earth was then dug away to allow the image to settle down into position, the ropes being used to steady it in the meantime. . . .

The fact that these huge monoliths rise from platforms recalls conditions in South Africa already considered where monoliths and gigantic birds stand on similar great stone platforms.

There is abundant evidence that Mr. Thomson has correctly interpreted the Easter Island colossi as "effigies of distinguished persons . . . intended as monuments to perpetuate their memory." Investi-

gation of the monoliths and colossi of other Polynesian islands points to the same conclusion regarding them.

Wherever we find the megalithic pillars in the Pacific we find them connected with a cult of the dead, and as we pass westward across the Pacific to the architectural wonders of Java where the stone working becomes more elaborate we find the same connection. The megalithic monuments of Polynesia have been repeatedly likened to the cromlechs and alligned stones of Stonehenge in England and Carnac in Brittany.

In the Penrhyn Islands there are small circles of stone described by Mr. Lamont that enclose an area some hundred yards square, "a sort of Stonehenge in a small way," and there are megalithic tombs in the Tonga Islands described in the *Natural History of Man* by Mr. Wood. The Australians likewise had stone circles with an upright stone slab in the middle.

In the Sandwich (Hawaiian) Islands we find the megaliths limited to walled enclosures like the pagan temple at Waikiki, but in Rapatiti there are massive stone forts. In the Friendly Islands, near the ancient metropolis of Tongatabu, there are 19 truncate pyramids, the stones composing which average 18 feet long by  $5\frac{1}{2}$  feet high and 3 feet thick weighing 20 tons each. Near these pyramids is a trilithon the uprights of which are 14 feet high, 8 feet wide and nearly 4 feet thick, weighing 15 tons, the cross-piece being somewhat smaller. They were transported over 3 miles by savages supposed to be ignorant of mechanical appliances.

In the Ladrões there are rows of stone columns, called the "houses of the ancients"; and massive walls built of basaltic prisms, 300 feet long and 35 feet high, exist in Ponape of the Caroline group.

Of the many archeological problems presented by the islands of the Pacific none are more instructive than the great heathen temple 51 feet by 39 feet in size, situated in a secluded valley in the center of Opala in Samoa. The adjacent tombs of the Tonga chiefs on these islands are marked with monoliths of enormous size.

#### NEW WORLD MEGALITHIC EPOCH

Mr. E. G. Squier in a brief pamphlet, "The Primeval Monuments of Peru compared with those in other parts of the World," published in the *American Naturalist* in 1870, arrived at the far reaching truth that megalithic monuments "seem to have been the spontaneous productions of the primitive man in all parts of the world, and not neces-



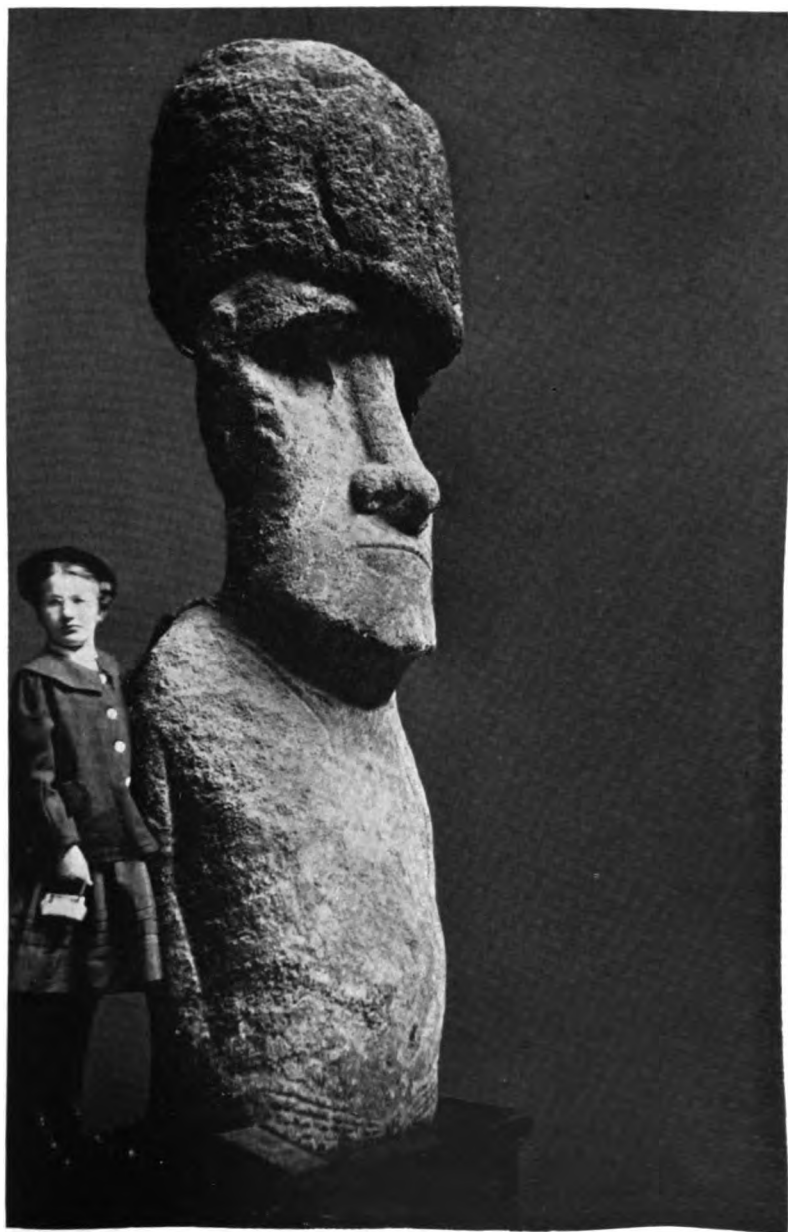


FIG. 27.—Stone image from Easter Island, in U. S. National Museum.  
Photograph by René Bache.

sarily nor even probably derivative." Other writers before and since him have recognized that truth, but no one had previously followed the resemblance of New and Old World megalithic structures.

Only a few of the more advanced people of America show evidences of the megalithic phase of culture, but the races dwelling on the Cordilleras of South America and those inhabiting the lowlands of



FIG. 28.—Stela F, Quirigua, Honduras, from Maudsley.

Central America were in this stage of cultural development before the discovery of America by Europeans. The best examples of megaliths occur in Peru, Colombia, Guatemala, Honduras, Mexico, and Yucatan, in all of which countries there are fine examples of both monoliths and colossi. They often bear glyphs or calendar symbols, which are characteristic of the New World as the Egyptian hieroglyphs are of the country bordering the Nile. No satisfactory evidence has yet been brought forward that phonetic writing arose independently on the American continent. The Indians of the terri-

tory of the present United States never developed a megalithic stage, although sporadic instances of natural rocks which have a religious rôle might be mentioned.<sup>1</sup>

Unworked monoliths or giant natural stones set upright singly or in numbers are found in both Central and South America, one of which from Argentina is as high as the head of a man on horseback.<sup>2</sup>

With few exceptions where we find monoliths and colossi, cyclopean walls likewise occur, evidently intended to express the same consciousness of power. This is particularly true of the Incas and pre-Incan races who handled the largest blocks of heavy stone and fitted them together with an accuracy that has astonished everyone from the time of their Spanish conquerors to the present.

We find in various parts of tropical America circles and alignments of monoliths recalling menhirs or cromlechs of the Old World, and called Indian corrals and ball courts. One of the largest and best known of these described by Schomburgk,<sup>3</sup> near San Juan de Maguana in Hayti, was formed of granite stones each from 30 to 50 pounds in weight and arranged in a ring measuring 2,776 feet in circumference. In the center of this dolmen was a rock over 5 feet high supposed to be an idol. Similar enclosures also with central idol found in Porto Rico were described by Dr. A. Stahl and others.<sup>4</sup>

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<sup>1</sup> Such natural monuments as the Snake Rock at Walpi or the Twin pinnacles at Tayallone, near Zuñi, or innumerable others which are mentioned in the folk-lore tales of Indians are not here considered, although like all monoliths they have a religious significance.

The stone "mountain lions" of Cochiti are sometimes rightly called colossi.

Mr. J. N. B. Hewitt has called my attention to the following from the "Histoire du Canada," by Sagard Teodot, which explains itself:

Ils m'ont montré plusieurs puissans rochers sur le chemin de Kebec, ausquels ils croyent presider quelque esprit, & entr'autres ils me monstrerent un à quelque cent cinquante lieues de là, qui auoit comme une teste & les deux bras esleuez en haut, & au ventre au milieu de ce grand rocher il y auoit une profonde cauerne de tres-difficile accès. Ils me vouloient persuader & faire croire à toute force avec eux, que ce rocher auoit esté autrefois homme morte comme nous, & que esleuant les bras & les mains en haut, il s'estoit metamorphosé en cette pierre, etc.

<sup>2</sup> See charts; Las Viejas Razas Argentinas. Felix Fuertes and Carlos Brusch. In the explanatory text occurs the following quotation that reminds one of bateys and similar structures in the West Indies: "Enciertos localidades se han encontrado piedras disuestas en circolo y paredes quisa in fin religioso."

<sup>3</sup> Sir Robert Schomburgk, Ethnological Researches in Santo Domingo. Report British Association, 1851.

<sup>4</sup> A. Stahl, Los Indios Borinqueños, Puerto Rico, 1889. J. Walter Fewkes, Aborigines of Porto Rico and Neighboring Islands, 25th Rept. Bur. Amer. Ethnology. 1907.

Peruvian and Bolivian "sun-circles," elsewhere mentioned, are structurally comparable with stone circles in Taumalipas and Vera Cruz, except that they approach the circular rather than rectangular forms.

As Egypt is the native land of the Old World obelisk and colossus, so Central America is the home of the colossi and commemorative

monoliths of the New. The American counterpart of Egyptian obelisks are the so-called stelæ of Tikal, Quirigua, Ocosingo, Copan, and the ruins of the valley of the Ucmacintla, in Honduras.

According to Mr. C. P. Bowditch<sup>1</sup>:

"Monoliths are scattered all over the northern and eastern slopes of the Cordilleras as they run through the State of Chiapas in Mexico, and through the Republic of Guatemala into Honduras . . . and in the whole extent of the peninsula of Yucatan. . . . The monoliths may be roughly divided into two kinds, according to their shape. One kind (called stela, plural stelæ) is tall, measuring in one case 28 feet in height, while they are not over 4 feet in width or depth. The others are low and take various forms, being square, oblong, or round as a rule, though some are carved in the shape of an uncouth animal."



FIG. 29.—Stela B, Copan, Honduras, from Maudsley.

Elsewhere Mr. Bowditch, regarding monoliths, calendaric or hieratic in character, quotes Landa, who states "that there were found in Mayapan seven or eight stones ten feet in length, unworked and with several rows of these (hieroglyphic) characters, and that the Mayas were accustomed to raise stones like these every 20 years." He likewise quotes Cogolludo, who says "that the Mayas counted the

<sup>1</sup> C. P. Bowditch, *The Numeration, Calendar Systems and Astronomical Knowledge of the Mayas*, Cambridge, 1910, p. 6.

ages by 20 years, which they call katun, and that they placed one worked stone on another on the walls of their temple at the end of these periods, as he himself has seen."

The stelæ of Copan and other related Central American ruins have carved upon them representations of men or women wearing sym-



FIG. 30.—Stela C, Quirigua, Honduras, from Maudsley.

bolic ceremonial paraphernalia, and like the Egyptian statues of Rameses are not intended for divinities but represent priests wearing symbols or headdresses characteristic of gods. These American monoliths or stelæ, like Egyptian obelisks, bear vertical rows of lines of hieroglyphs; they generally stand in front of temple mounds or on ceremonial plazas, in much the same relative position as obelisks, indicating by the position, general form, and accompanying glyphs that they are both memorial and religious in character.

The great animal effigies of the Lake of Menagua in Nicaragua, described by Dr. Carl Bovallius, belong to the group of monoliths architectural rather than religious in character, being intermediate between unworked monoliths and colossi. Perhaps the best known Aztec megalithic statue is that called Huitzilopochtli, the God of War, which Mr. Payne,<sup>1</sup> with good reason, identifies as the Corn Snake goddess, a colossal representation of an effigy made of corn stalks used in ceremonial dances. The great stone tiger found a short time ago in excavations made in a street back of the cathedral near where the



FIG. 31.—Turtle, Quirigua, Honduras, from Maudsley.

old temple of the Aztecs once stood in Mexico City, is a colossus, and the giant serpent's head, part of the ancient wall of the temple now set in the foundation of an adjacent modern building, belongs to the same category.

Although expressions of the megalithic consciousness were less pronounced among the Totonac and Huastec people of the coast of the Gulf of Mexico than in Central America, or the valley of Mexico, statues from Xico Viejo, near Jalapa in the state, Vera Cruz, and the neighborhood of Tampico, in Tamaulipas, have been figured in the speaker's account of the antiquities of eastern Mexico.<sup>2</sup>

<sup>1</sup> Edward John Payne, *History of the New World called America*, Vol. I, p. 470. Oxford.

<sup>2</sup> Twenty-fifth Annual Report Bureau of American Ethnology.

No colossi have been reported from the Gulf coast north of Tulum, but the pillar stones in rude human form, like those of the Huastecs,<sup>1</sup> occur from Cuba to St. Vincent, West Indies, showing the presence of the monolithic feeling among the former people of the Antilles, as well as the Spanish Main.

Our studies of megaliths in America would be incomplete were we to neglect the cyclopean buildings of Peru, with monoliths so remarkable that they have excited the imagination of all travellers. Considerable literature<sup>2</sup> exists regarding these structures; the impression after reading descriptions of them is of great wonder at the magnitude of these buildings.

Mr. E. G. Squier<sup>3</sup> has figured and described one of these monuments which he aptly designates the "American Stonehenge":

The temple seems to me to be the most ancient of all the distinctive monuments of Tiahuanaco. The stones defining it are rough and frayed by time. The walls between its rude pilasters were of uncut stones; and although it contains the most elaborate single monument among the ruins, and notwithstanding the erect stones constituting its portal are the most striking of their kind, it nevertheless has palpable signs of age, and an air of antiquity which we discover in none of its kindred monuments. Of course, its broad area was never roofed in, whatever may have been the case with smaller, interior buildings no longer traceable. We must rank it, therefore, with those vast open temples (for of its sacred purpose we can scarcely have a doubt) of which Stonehenge and Avebury, in England, are examples, and which we find in Brittany, in Denmark, in Assyria and on the steppes of Tartary.

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<sup>1</sup> Ed. Seler. *Die Alten Ansiedelungen im Gebiete der Huasteca*. Berliner Anth. Gesells., 1888.

The "*Steinfiguren*" figured by Dr. Seler and the rectangular enclosures, *tlachco*, of the Cerro el Cangrejo near Chila, in the neighborhood of Tampico, remind me of the Porto Rican "*batey*" and rude pillar stones of the West Indies. Mr. Joyce has figured a pillar stone in the British Museum said to have come from Nevis in the West Indies, which is a statue comparable with the Huastec, but shows marked old world influences. Mr. Connell of St. Kitts has a similar pillar stone also from Nevis.

<sup>2</sup> Several writers refer these megalithic monuments to a pre-Incan civilization. Good authorities might be mentioned in support of the belief that the megalithic monuments of Peru belong to different cultures.

<sup>3</sup> *Op. cit.* Later authorities, Strübel and Uhle, and Sir Clements Markham, especially the last, have greatly enlarged our knowledge of Incan and pre-Incan megaliths. Some very large rocks at Cuzco are still rough, while the stones at Ollantaytambo are smooth. The monoliths of Abancay and the Cuzco stones are instructive megaliths.

The great monolithic gateway of Tiahuanaco, Peru, is the best known megalith of South America. In describing this structure Squier says:

We must imagine a block of stone, somewhat broken and defaced on its edges, but originally cut with precision, 13 feet 5 inches long, 7 feet 2 inches high above ground, and 18 inches thick. Through its center is cut a doorway, 4 feet 6 inches high, and 2 feet 9 inches wide. Above this doorway and as it now stands on its southeast side or front, are four lines of sculpture in low relief, like the Egyptian plain sculptures, and a central figure immediately over the doorway sculptured in high relief. On the reverse we find the doorway



FIG. 32.—Monolithic gateway, Tiahuanaco, Peru, from Stübel and Uhle.

surrounded by friezes or cornices, and above it on each side two small niches, below which, also on either side, is a single larger niche. The stone itself is a dark and exceedingly hard trachyte. It is faced with a precision that no skill can excel.

Among other examples of South American structures illustrating South American monoliths may be mentioned the sun-circles (*intihuatana*), first described by Squier, of Sillustani and the stone pillars of Hatuncolla, the latter decorated with figures of serpents, lizards, frogs, and elaborate geometrical designs. The sun-circles<sup>1</sup> consist of rings of well-fitted flat stones forming a platform, on the inner edge

<sup>1</sup> The best description of these known to me is found in Bandelier's "The Aboriginal Ruins at Sillustani, Peru" (*American Anthropologist*, Vol. 7, No. 1, 1905). There are a number of sun-circles, less carefully built, on the height called Kajopi, above the village of Huata in Bolivia, according to this authority.



of which are erect uncut stones arranged in ring shape, while in the enclosure thus formed are other upright stones that also show no sign of tools. These sun-circles reminded Squier of megalithic monuments of England and northern Europe, and in certain particulars they recall to my mind the bately<sup>1</sup> or ball courts of the West Indies, Mexico, and Central America.

In the limited time available only a few of many megalithic structures in Peru can be instanced, the list might be much enlarged by



FIG. 33.—Monolithic "gateway," Tiahuanaco, Peru, from Stübel and Uhle.

the addition of monolithic doorways and other examples, but these suffice to show that the erection of megaliths attained a high development in South as in Central America. A people where this power was so highly developed naturally built stones of great size into their temples and fortresses as that of Sacsahuaman, which Squier regarded the greatest specimen of cyclopean style in America. The measurements of the size of the corner-stones of buildings at Cuzco, or salient angles of the component stones of the trinchera-like walls of this fortress are extraordinary; one of the foundation stones is said, by Squier, to be "27 feet high, 14 broad, and 12 in thickness."

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<sup>1</sup> Compare with Squier's cut of these sun-circles the ball court or bately described by Schomburgk, in Santo Domingo, West Indies.

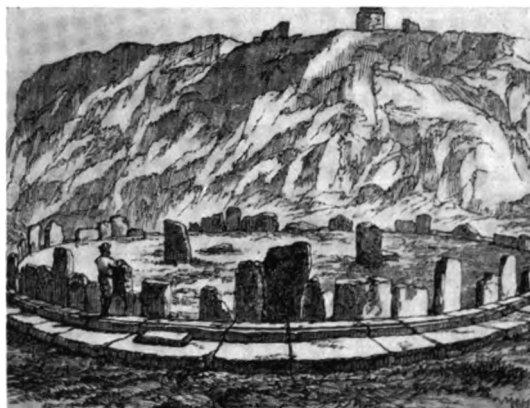


FIG. 34.—Sun-circle, Sillustani, Peru, from Squier.

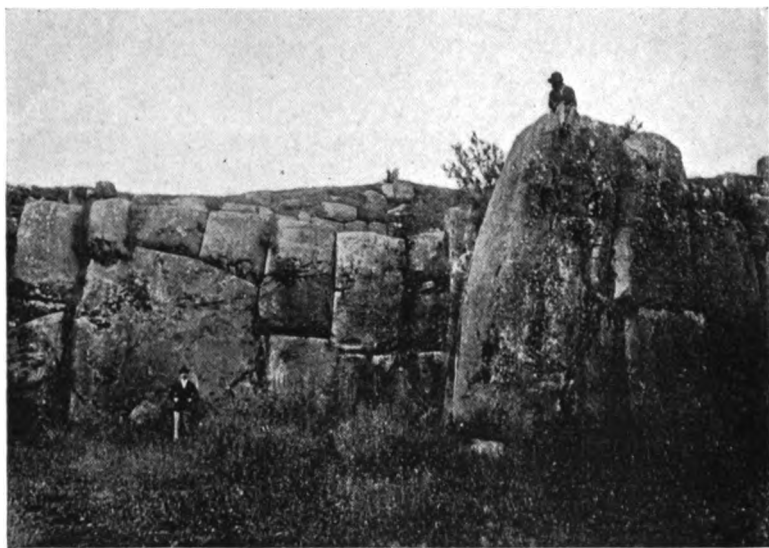


FIG. 35.—Colossal wall, Cuzco, Peru, from Squier.

The plain near Acora, Peru, is covered with many rude monuments in the forms of circles and rectangles constructed of unwrought upright stones, which Squier finds "almost identical" with cromlechs of Europe, and "might be transferred to Brittany or Wales and pass for structures contemporary with the thousand rude monuments of antiquity found in those regions."

The long, and at times seemingly tortuous, trail we have followed has led the speaker to the following generalization. Although the megaliths are among the oldest buildings or architectural structures erected by man, all, from the simplest to the most complex, belong to a series wholly distinct from that including habitations of the living. From the rude uncut monoliths to the perfection of architectural expression, the Parthenon, there are many and varied forms of religious edifices, temples, and shrines, but none of them were erected primarily as human residences. Man has never built as good a dwelling for himself as for his ancestors or gods. Man's noblest architectural efforts are not for abodes for himself while living, but in response to



FIG. 36.—Corner of massive wall. Cuzco, Peru, from Squier.

a striving for ideals far higher than personal vanity or shelter for his family. Even dwellings of despots shrink into insignificance in comparison with the creations of a race influenced by the highest religious feeling. The habitations of the builders of the great temples whose ruins astound us by their magnitude, are forgotten; they do not belong in the same series as the megaliths we have studied; they were built by individuals for shelter and personal comfort. Megalithic monuments are expressions of a community feeling influencing man to coöperate for ideals higher than self and should be judged by a very different standard. Temples are not modified human dwellings, but evolutions of the same religious ideal which led man in early times to erect monoliths and colossi.

After what has been said on the geographical distribution of monoliths we may dismiss without serious consideration the theory that they were made by one and the same great race. Equally unattractive is the specious corollary that migrations of culture, save within limits, can be traced by them.

They represent a phase of religious thought, of spontaneous origin almost identically expressed. Commonly associated with tombs or burial places, they are almost universally connected with the cult of the dead. They are both cultural and religious, or expressions of a phase of racial feeling at a time before the two had been differentiated.

In closing it is well to emphasize the main object of the preceding pages and to point out that monoliths and colossi are geographically widespread and not limited to one continent or to any one race of man.

They express a profound racial self-consciousness of power amounting to a religious feeling; incidentally as in arts,<sup>1</sup> institutions, beliefs, and languages, environment furnishes material for or modifies the expression of this consciousness and stimulates endeavor, but culture is due to mental efforts to overcome environment by invention.

If you will bear with me for a few moments longer I will close with a plea for the comparative method of study in culture history. The objection that the existence of megalithic structures with like form and meaning in both the Old and New Worlds does not indicate derivation of one from the other is a lame argument against the use of the comparative method of discovering what has caused these resemblances. The speaker would heartily agree that likenesses in the megalithic habit do not indicate identity of culture, but he believes that these resemblances have a deep significance which comparisons may reveal.

As is apparent to those familiar with the literature of archeology, few new facts are here added to our knowledge of great stone monuments, nor is it claimed that the comparison of monoliths of the Old and New Worlds is an original thought. An attempt has been made to show, by a comparison of similar stone objects, that there is a unity in mental action among very different races of man, and that this similarity, modified somewhat in expression by geographical environment, is an important factor in human history.

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<sup>1</sup> Of late the term "material culture" is commonly used by ethnologists in a rather loose way, apparently embracing all material objects characteristic of culture. This is a convenient term, but the intrinsic association of religion and culture cannot be lost sight of in studies of human expression.

SMITHSONIAN MISCELLANEOUS COLLECTIONS

VOLUME 61, NUMBER 8

# THE COMPARATIVE HISTOLOGY OF THE FEMUR

(WITH THREE PLATES)

BY

DR. J. S. FOOTE

Professor of Histology and Pathology, Creighton Medical College,  
Omaha, Nebraska



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# THE COMPARATIVE HISTOLOGY OF THE FEMUR.

By DR. J. S. FOOTE

PROFESSOR OF HISTOLOGY AND PATHOLOGY, CREIGHTON MEDICAL COLLEGE,  
OMAHA, NEBRASKA

(WITH THREE PLATES)

The comparative study of the minute structure of the femur was begun by the present writer in 1909. The first report described 46 microsections of the femora of as many different animals and was published in the Transactions of the American Microscopical Society of April, 1911. Following the first report and largely upon the suggestion of Dr. Aleš Hrdlička, Curator of the Division of Physical Anthropology in the United States National Museum, the writer has extended his investigations to man of different ages and races, as well as to many additional genera and species of animals; and an abstract of these further studies which revealed many important and new points, is here presented.

For the valuable material, facilities for study, and courtesies extended, the writer is especially indebted to the Division of Physical Anthropology of the United States National Museum; and to the Division of Mammals and Reptiles of the same institution; the Departments of Reptiles, Birds, and Mammals of the American Museum of Natural History, and the Departments of Anatomy and Medicine of the Northwestern, the Tulane, and the Creighton Universities.

The total number of genera and species whose femora have up to this date been examined amounts to 400, including amphibians, reptiles, birds, mammals, and man. The observations have been made on complete cross-sections of the femur at the middle of the shaft. Embryological, adolescent, adult, and senile bones of the same species were examined whenever it was possible, and controlling studies were also made on other bones of the body. The drawings have been made for the most part with the aid of the Edinger apparatus.

The investigations, which are of pioneer nature, have brought out many facts that are new to science. The existence of three types of

bone, together with a number of combinations of these types, is established. They might be called the early, intermediate, and advanced, or, more definitely, the undifferentiated, laminar, and Haversian-system types. As a matter of convenience they will be referred to as the first, the second, and the third types, respectively. They are illustrated in plate 1. They are doubtless connected intimately with vascular development, and may be defined as follows:

The *first type* (pl. 1, fig. 1) is composed of homogeneous bone substance enclosing more or less numerous lacunæ, from which radiate their minute canaliculi. It is very poor in vascular canals. The lacunæ present a simple concentric arrangement; they may be comparatively few or many in number; they may be round or oval in shape, with few or again many canaliculi; and the bone may show an approach to the simplest form of lamination.<sup>1</sup>

The *second type* (pl. 1, fig. 2) is composed of groups of concentric laminae which show vascular canals running parallel to the axis of the bone, as well as about the laminae, and are frequently crossed by smaller canals running in various directions. The lacunæ are considerable in number, and may be oval, or long and narrow, according to the species.

The *third type* (pl. 1, fig. 3) is composed of Haversian systems, such a system is defined by Cunningham as follows: "The Haversian system consists of a central or Haversian canal which contains a vessel of the bone. Around this osseous lamellæ are arranged concentrically, separated here and there by interspaces called lacunæ, in which the bone corpuscles are lodged. Passing from these lacunæ are many fine channels called canaliculi. These are disposed radially to the Haversian canal and pass through the osseous lamellæ. They are occupied by the slender processes of the bone corpuscles."

These three types, either singly or in combination, enter into the formation of the femora of all animals; and there is no suggestion of any additional form of bone structure. Taken as a whole, combinations of types are more common in the structure of bone than single types, and are more frequent in the mammals than in the classes below them.

<sup>1</sup> The term *lamellæ* is restricted in this paper to the small concentric layers of bone surrounding the Haversian canal, while that of *laminae* is applied to the larger more or less irregular rings of bone that run concentrically in relation to the medullary canal.



As to the significations of these types, the subject has been studied from the following standpoints :

- (1) The grade of the animal in biological classification.
- (2) Geographical location.
- (3) Sex.
- (4) Age.
- (5) Function.
- (6) Individuality.
- (7) Health ; and
- (8) Heredity.

1. The first type of bone appears as the basic structure in the amphibians, reptiles, birds, and mammals. It exists, in a pure or but little complicated form, throughout life, in the amphibians, in the lizards, in some of the birds, and in the bats, excepting the Pteropus. It exists or predominates in the fetal life of higher animals, including man. It may well be regarded as the simplest and oldest or fundamental form of bone structure. Its first variation is shown by a change of the round or oval to long and narrow lacunæ, by a more concentric arrangement of the lacunæ, and by increase in vascularity, which is accompanied by a change from the first to the second or third type of bone structure.

The second or intermediary type of bone structure develops as a rule from the first type and represents often, though not invariably, a stage in the differentiation of the bone from the first to the third type. Traces of it are seen first in the amphibians and reptiles, while more pronounced instances of it occur in a few birds, some of the mammals, and at some stages of development, especially in some races, in man. It is best represented in certain mammals, such as the various deer.

The third type, foreshadowed in a few amphibians, appears in part in some of the reptiles and a few birds ; it is more strongly represented in certain mammals, and is characteristic of man.

2. The effect of *geographical position* upon bone variation is not yet reducible to exact deductions. However, it is a fact that the femora of the African and Asiatic elephants differ from each other very materially.

3. As to *sex*, the femora examined showed no evidence that this is an important factor in the minute structural variation of the bone.

4. *Age* influences the type of the bone very greatly ; at least so in the higher mammals and particularly in man. All femora of higher mammals, and especially man, change in structure with advancing

development of the subject. Some femora, however, arrive at a completion, or rather at a cessation of the changes, regardless of the stage reached, earlier than others. The only future change in such bones is senility. The progress, however irregular or incomplete it may be, is always from the first towards the second or the third type, never the reverse.

5. The effect of *function* upon variation in bone structure can scarcely be doubted, but the exact causes and effects are as yet difficult to determine. In the study of 50 genera of bats, the small *Pteropus* presents still, like the rest of the bats, the first type of bone structure, while the large *Pteropus* shows already an early and crude third type in process of formation. In a turkey of 16 pounds weight only the second type appeared, while in a turkey of 32 pounds weight there was noticeable a number of Haversian systems. In many femora of all classes the *linea aspera*, the most "functional" part of the bone, is composed chiefly of third type units regardless of the type of the rest of the bone. Finally, a lack of function in an adult bone doubtless favors an earlier setting in of senile changes.

6. *Individual* variations are rare in the lower vertebrates and increase in frequency in the higher forms. But they are mostly of secondary importance, the characteristic structure in species remaining pretty true. The slight variations present are probably partly accidental, partly hereditary and partly functional.

7. Variations due to *health and disease* remain very largely for studies in the future. They will be almost wholly restricted to man.

8. *Hereditary influence* finally, is clearly demonstrated by the predominance of a certain form of structure in every given species. In families the subject needs much further attention.

## DETAILS CONCERNING GENERA

### AMPHIBIANS

The amphibians present the following conditions:

1. Simple first type bone with round and oval lacunæ and few canaliculi. In some forms cancellous bone occupies the medullary canal; this is seen, for instance, in the *Amblystoma tigrinum*, one of the most primitive amphibians.

2. A division of the simple bone into two concentric laminæ, external and internal.

3. A differentiation into external, central and internal laminæ; and

4. In a few amphibians, as in the Toad group, very crude Haversian systems become outlined in the central lamina. These primitive

systems are composed of Haversian canals communicating with adjacent lacunæ by a few canaliculi. No concentric arrangement of the lacunæ and no Haversian system lamellæ are in evidence.

#### REPTILIANS

The reptilian femora show much the same conditions as those of the amphibians, but the differentiation of bone structure has in some forms advanced to a greater extent. Some species present the simple first type of bone. This is especially the case in the lizards. But in the turtles, curiously, a fairly well developed third type of bone structure has made its appearance. Again cancellous bone, which is not a structural feature of the lizards, is generally present in the turtles. These are remarkable differences and separate widely the two genera.

#### BIRDS

Birds present in general the appearance of an incompleated development of the structural state. The first, second, as well as the third type of bone structure are found, and also various combinations, but all give the impression of incompleteness. The bone units are rather dim and unsatisfactory. The first type is present in some birds and is generally of a very simple form. The second type appears in a larger number of species and is, perhaps, the most representative type in birds. In some of these femora a few Haversian systems appear, especially in the posterior ridge, and in some birds of large size the second type structure is reinforced by some Haversian systems in the anterior wall. Finally, in a few species the central ring of lamellæ has become displaced by Haversian systems and the bone must be classified as that of the third type. As a rule the systems are rather dim and do not stand out clear cut. Their lacunæ are oval and their canaliculi bushy. In a few birds the medullary canal is occupied by cancellous bone. In about half the bird femora the medullary canals are full of marrow, while in the remainder they are empty. Comparing the birds with the reptiles, there is a distinct increase in the proportion of differentiation, although this has not reached full development.

#### MAMMALS

In these animals the bone structure is in general much more differentiated than in birds. As a rule the types and their combinations have lost the illy defined characters so frequently present in the foregoing classes. Furthermore, type combinations are more common.

The first type is present in certain genera. It was found in 50 different genera of bats and a number of genera of shrews. In a few of these forms the division of the bone substance into three concentric rings has occurred. In one genus, the *Pteropus*, this modification is well marked, and beyond that, rather crude Haversian systems are found in the central ring, the bone showing thus an advance toward the third type.

Quite a large number of mammalian femora present a well marked second type structure. The laminae are well developed, and enclose long, narrow lacunae, with straight canaliculi. In all these bones Haversian systems are found in the posterior ridge corresponding to the linea aspera. A few mammals show a pure third type of bone structure. In such animals the first and second types are eliminated and fully developed Haversian systems have taken their places. But only three or four of the 178 mammalian femora (other than bats and shrews) examined were composed of this type.

By far the greatest number of mammalian femora shows combinations of the first and third type. In these bones the structural units are well developed, but vary much in proportions. But they frequently occupy the same relative positions. The laminae, with bone structure of the first type, are external and internal, while the Haversian systems occupy the central ring. The second and third types form the structure of also a large number of mammals. In this combination the units are well developed and about equally important. Finally, in still another large group of mammals, the femora show all the first, second and third types of bone structure, in varying proportions.

Looking over the mammals as a whole, it is noticed that their femora exhibit structural differentiation much more advanced and definite than that observed in the femora of other animals. From species to species there are many variations.

It is a peculiar fact that amphibians, reptiles, birds, and mammals all present, though in a widely varying proportion, the first type as well as some form of advanced type of bone structure. The advanced type is the variable factor and occurs in the greatest variety of forms and combinations. The early or first type differs merely in simplicity. It is more simple in the amphibians than in the mammals. The third type, on the other hand, in amphibians, merely a suggestion, is better developed in reptiles, still better in birds and in mammals reaches its highest state of advancement. Clean cut, well developed third type

units are not at all common below mammals, but are the important structures of mammals and especially man.

#### MAN

The human fetus presents in varying combination the first and second type of structure with wide canals and incompletely formed lacunæ. As development progresses, the first and second type bone is gradually displaced by the Haversian system structure.

More in detail, in the very young human fetus of two to three months, the first type of bone structure is present in an incomplete form and is marked off into irregular areas by crude, branching canals. As fetal life advances the canals become less branching and more concentric. Gradually the first becomes the second type of bone and remains so until about one year after birth, when sufficient differentiation has occurred by the formations of Haversian systems to make it second and third type, or first, second and third type combination. Throughout childhood and youth, the laminæ tend to disappear and to be replaced by Haversian systems, until the bone development is completed. In the early period, a horseshoe-shaped band of laminæ is often observed forming the anterior and lateral walls of the bone. A remnant of this horseshoe may remain throughout life in those femora which do not complete the third type differentiation. The proportion of this remnant to the other bone units in the adult bone varies greatly and the result is that adult femora present many secondary variations.

A white child, a Pueblo Indian, and a Peruvian Indian child, each about one year of age, exhibited already a combination of the second and third types of bone structure. A femur of an Egyptian child of the XIIth Dynasty showed the development of the Haversian system directly from the circulation, which is an evidence of the causal association of bone structure with the development of the vascular system of the bone.

On the whole, the study of human femora from fetal life and childhood shows various transitional stages from the first and second to the third type of bone.

#### ADULT HUMAN FEMORA

The adult human femora are, in general, characterized by the predominance of a well differentiated third type of structure. An

exclusive presence of the first type of structure has never been found in the adult human femur. The most primitive form is a combination of the first and third types. The proportions of the structural units varies greatly. In some femora, the first type was found to amount to more than half of the section, while in others it is reduced to a small fraction. In other human femora there will be a second and third, instead of first and third type combination; and still others, the bone shows all the three types. When the first type is present, it is generally found in the form of a horseshoe band extending under the external surface of the bone—the heel of the shoe embracing the posterior ridge. Segments of laminae with a first type of bone, frequently found in bone sections, are the remains of a disappearing horseshoe band of first type units. In a complete third type bone, the first and second type units have been entirely displaced by well developed Haversian systems. There may be cancellous bone around the medullary canal.

Three human races have been examined, namely, the black, the white (including the ancient Egyptian), and the yellow-brown. An early and late differentiation has been found in each. The negro, modern white, Egyptian of the XIIth Dynasty, the Pueblo and Peruvian Indians all show these variations. The variations are the same in kind, but somewhat different in degree. The negro bone, barring individual exceptions, does not perhaps equal that of the other races in the degree of the differentiation.

The posterior ridge is generally composed of Haversian systems. This occurs in each race.

Senile changes, absent or very rare in animals, are unexpectedly frequent in human femora, particularly those of civilized races.

#### SENILE CHANGES

After a human bone has reached its developmental limitation and perhaps the climax of its function, it soon begins to undergo certain changes which are properly those of degeneration of senility. Such changes are evidently far more common than is supposed. Age in years is not to be the determining factor. A femur may be more or less senile at 30 or 40 years of age. There is no structural differentiation beyond the Haversian system type; when that has been completed it may remain as such for years, but sooner or later a process of aging sets in. The senile changes begin around the canals of the Haversian systems. They involve first the systems around the medul-

lary canal. As the changes extend the bone becomes lighter in weight and its walls become thinner (pl. 3, figs. 1, 2, 3, 4, 5). It is a slow destruction.

TABLE OF TYPE PERCENTAGES

	Amphibians	Reptiles	Birds	Mammals	Man—Adult	Man—Fetus Child, Youth
Number.....	34	35	39	178	105	13
First type.....	97%	77%	30%	23%	0%	0%
Second type.....	0	0	23%	13%	0	54.8%
Third type.....	0	0	10%	2.5%	37%	0
First and second type.	0.3%	0	2.5%	0	0	7.8%
Second and third type	0	0	13%	11%	13%	14.3%
First and third type..	0	0	11%	27.5%	33%	77%
First, second and third type.....	0	0	5%	11%	15%	15.4%
Undeveloped third type.....	3%	23%	5.5%	7%	0	0
Medullary canal, full.	100%	100%	54%	100%	100%	100
Medullary canal, empty.....	0	2%	46%	0	0	0
Senile.....	0	0	0	0.1%	56%	0







Fig. 1



Fig. 2

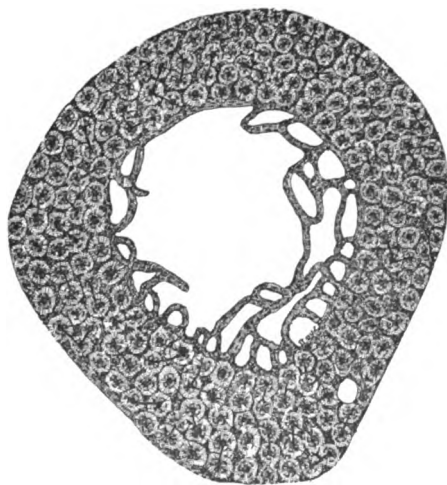


Fig. 3

### THE THREE TYPES OF BONE STRUCTURE

FIG. 1.—First type as seen in the amphibian, *Nyctalus aviator*.  
 FIG. 2.—Second type as seen in the turkey.  
 FIG. 3.—Third type as seen in man.



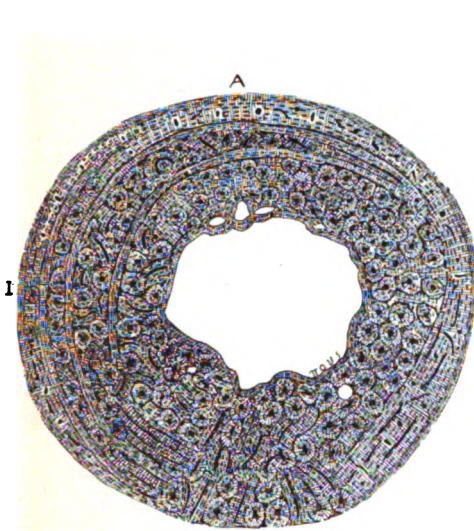


Fig. 1



Fig. 2

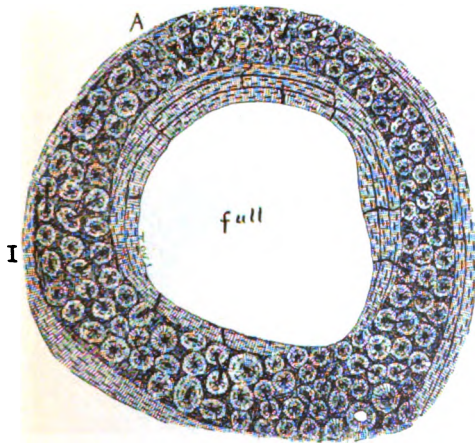


Fig. 3

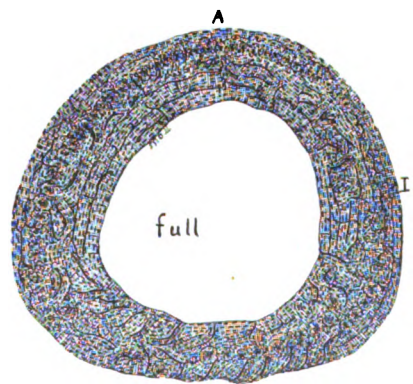


Fig. 4

SECTIONS OF FEMORA, SHOWING VARIOUS COMBINATIONS OF TYPES.

- FIG. 1.—Right femur of a sloth bear, *Melursus labiatus*. No. 2272, A. M. N. H.  
 FIG. 2.—Left femur of a jackal, *Canis*. No. 7172, U. S. N. M.  
 FIG. 3.—Right femur of a coyote, *Canis latrans*.  
 FIG. 4.—Left femur of a badger, *Taxidea Americana*.



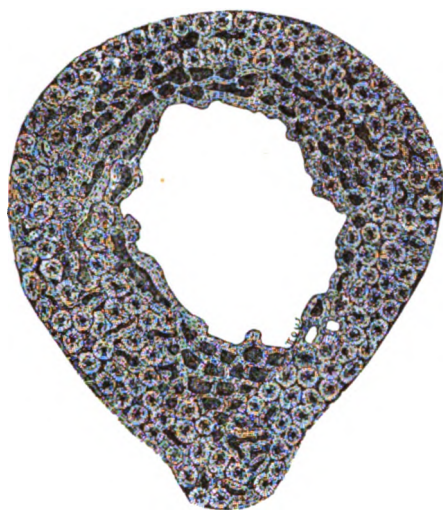


Fig. 1



Fig. 2

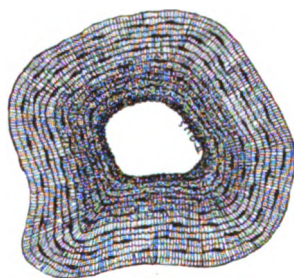


Fig. 3



Fig. 4

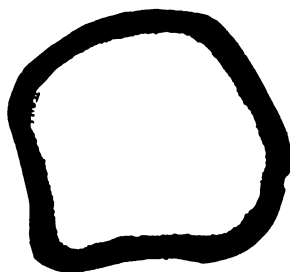


Fig. 5

## SENILE CHANGES IN THE HUMAN FEMUR

- FIG. 1.—Left femur of a colored man. Large black spaces represent senile absorption of bone.  
 FIG. 2.—A single Haversian system, much enlarged, without definite signs of senility.  
 FIG. 3.—A single Haversian system, much enlarged, showing early signs of senility.  
 FIG. 4.—A single Haversian system, much enlarged, showing a later stage of senility.  
 FIG. 5.—A single Haversian system, much enlarged, showing the latest stage of senility.



SMITHSONIAN MISCELLANEOUS COLLECTIONS

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# NEW RACES OF UNGULATES AND PRIMATES FROM EQUATORIAL AFRICA

BY

EDMUND HELLER

Naturalist, Smithsonian African Expedition



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## NEW RACES OF UNGULATES AND PRIMATES FROM EQUATORIAL AFRICA

By EDMUND HELLER

NATURALIST, SMITHSONIAN AFRICAN EXPEDITION

The present paper deals with African mammal material in the United States National Museum collected by the Smithsonian African Expedition under the direction of Colonel Theodore Roosevelt and by the Paul J. Rainey Expedition to British East Africa.

### **GORGON ALBOJUBATUS MEARNSI, new subspecies**

Loita White-Bearded Wildebeest

*Type* from the Loita Plains, British East Africa; adult male, Cat. No. 163020, U. S. Nat. Mus.; shot by Dr. E. A. Mearns, June 28, 1909; original number 6809.

*Characters.*—Differs from the typical *Gorgon albojubatus* of the Athi Plains by dark colored limbs, smaller body size, the skull being decidedly less in length; and less widespread horns which are curved downward well below lower margin of orbit and about level with the foramen magnum. In *albojubatus* the horns extend much more horizontally, their lower edge not extending below the lower edge of the orbit.

Coloration of type: dorsal color drab-gray spotted and banded by dark patches due to the tips of the hair becoming dark brown as though representing an old worn pelage, the new alone being drab-gray. This faded condition of the hair is not seasonal but is a chronic condition in the wildebeest. Limbs darker than the body, uniform olive-brown deepening somewhat on the pasterns. Chest, fore part of belly and lower sides much darker than the back, clove-brown, the chest medially black. Groins, axillæ and inside of legs drab-gray like the back. Tail like the back in color and furnished along the lower surface and at the tip with a long black tuft of hair fully as long as the tail itself. Neck like the back in ground color but showing ragged cross bands of dark hair bases; a mane of long black hair extends the whole length of the nape and is continued as a black line on the back as

far as the rump. The throat marked by a mane of long buffy or whitish hair from the chin to the chest. Top of snout from the interorbital region to the muzzle and far down on the sides to the lower level of the eyes deep black, the blackness at muzzle spreading down around the mouth and uniting with the black chin; the upper lips whitish at tip of snout and walnut-brown on the sides. Sides of head drab-gray like the neck with a slightly lighter streak bordering the black face blaze from the eye to the angle of the mouth. Crown seal-brown and showing some contrast to the black forehead. Back of ears black and united with the dark crown patch by a narrow bridge of dark color, rest of base and inside pale drab-gray.

No flesh measurements of the type are available but an adult male specimen from the same locality, No. 181851, U. S. Nat. Mus., had dimensions in the flesh as follows: Head and body, 2,000 mm.; tail, 645; hindfoot, 515; ear, 200. The skull of the type shows considerable age, the last molars showing wear, the horn points being much worn down and the fronto-nasal suture quite obliterated. Condylobasal length, 430; greatest length, 457; greatest breadth, 185; nasals,  $222 \times 40$ ; orbit to gnathion, 300; length of premaxillæ, 192; vertical diameter of eye, 58; upper tooth row, 101; width of palate across  $M^1$ , 95; tooth row to gnathion, 142. Length of horns on curve,  $15\frac{1}{2}$  inches; greatest spread,  $20\frac{5}{8}$  inches; spread at tips,  $13\frac{1}{2}$ .

A series of twelve skins, with their skulls, of this new race is in the National Museum from the Loita Plains and six skins and skulls from the Kapiti or Athi Plains representing *albojubatus*. The series from the Loita representing *mearnsi* shows much darker legs accompanied by darker body color on the chest, sides and underparts. In the typical *albojubatus* of the Athi the legs are drab or tawny-olive and never as dark as olive-brown or sepia. No difference in the color of the throat, mane or forehead is evident in these two series but the ears at the base in *albojubatus* show a tendency to lose the bridge of dark color from the back of the ear to the crown patch. The horns in the Loita Plains specimens agree in showing a much deeper sweep downward from the head than do those of typical *albojubatus* from the Athi Plains.

*Gorgon* has been employed as the genus of the brindled wildebeests owing to their marked distinctness in skull shape and horns from the white-tailed gnu which is the type of the genus *Connochates* of Lichtenstein. *Gorgon* was proposed by Gray in 1850 for the brindled wildebeest, *G. taurinus*.

**BUBALIS LELWEL KENIÆ, new subspecies****Kenia Lelwel Hartebeest**

*Type* from the North Kenia Plateau, 20 miles northeast of Nyeri near the Meru road; adult male, Cat. No. 182009, U. S. Nat. Mus., shot by Paul J. Rainey, June 27, 1911; original number, 2310.

*Characters*.—Resembling *Bubalis lelwel jacksoni* closely in coloration and size but differing by the more widely spread or divergent horns and by decidedly shorter horn pedicle. From *cokei* or any of its races it is at once distinguishable by its V-shaped horns, longer head and larger body size.

Dorsal coloration uniform cinnamon-rufous, the color becoming gradually lighter on the sides and belly where it is ochraceous-buff. Legs like the sides without any black markings except a black border to the clefts of the hoofs in front. Terminal half of tail furnished with a long black tuft. Crown of head and snout darker and more rufous than the back. Ears like the back except on inside where they are clothed by white hair. Tip of chin black in marked contrast to the tawny throat.

Dimensions of the type in the flesh: head and body along curve of back, 2,000 mm.; tail, 570; hindfoot, 540; ear, 280. Skull: condylo-basal length, 431; greatest length from bifurcation of horn pedicle, 495; length of horn pedicle from bifurcation to orbit, 143; least width of pedicle, 111; gnathion to tooth row, 150; width of palate across PM<sup>2</sup>, 88; length of premaxillæ, 140; nasals, 223 x 42; vertical diameter of orbit, 50. Adult, but not aged, the teeth showing very little wear.

There is one other specimen in the collection besides the type. This is also a male but from a locality some 20 miles farther west. It is much younger than the type having just shed its milk molars. In coloration it is quite light, being uniform buff in color without the rufous tinge of the type.

The horns of the type are broadly V-shaped with the tips turned sharply backward at right angles and parallel in direction. Length along front curve, 21¼ inches, spread at tips, 10¼ inches; circumference at base, 11¾ inches. The horn pedicle is much wider than in *jacksoni*, the least width being considerably greater than two-thirds of the length.

The Kenia lelwel is confined to the plateau region drained by the Northern Guaso Nyiro and flanking Mount Kenia on the north. It represents the extreme western range of the lelwel type of hartebeest.

Westward it connects with true *jacksoni* in the region west of Lake Baringo. It occurs in very limited numbers, is exceedingly wary and is seldom secured by sportsmen.

**SYLVICAPRA GRIMMIA DESERTI, new subspecies**

Desert Bush Duiker

*Type* from Voi, British East Africa; adult male, Cat. No. 182219, U. S. Nat. Mus.; collected by Edmund Heller, October 27, 1911; original number, 2532.

*Characters.*—*Sylvicapra grimmia deserti* is decidedly lighter than the other East African races of bush duikers with more vertically directed horns and shorter pelage. Body size large. Dorsal coloration buffy without any approach to the tawny color of the highland races and with the dark chin spots obsolete or but faintly indicated.

Color of the type: dorsal color buff speckled very lightly by narrow dusky vermiculations to the hair; underparts white, the breast showing but a slight tendency toward the ochraceous color of *hindei*. Legs buffy like the body but lacking the darker vermiculation; from the fetlocks to hoofs solid fuscous-brown which is continued upward in front as an indefinite darker leg stripe. Tail with a median black dorsal stripe, the sides and under surface white in sharp contrast. Head ochraceous marked by a broad seal-brown or black median stripe from the muzzle to the horn bases. Lips, chin, and forethroat white, the chin marked on sides by two faint drab-gray spots representing the blackish patches of *hindei*. Eye lashes and anteorbital stripe black. Ears on back covered by a short scattered growth of ochraceous hair but general color tone dark brownish due to the dark skin; inner side and base white. Throat and nape ochraceous-buff, slightly darker than the body.

Measurements of type in the flesh: Head and body, 810 mm.; tail, 110; hindfoot, 260; ear, 105. Skull, adult, with last molar in place but with milk molars still in use: greatest length, 166; condylo-basal length, 156; greatest breadth, 72; nasals, 63 x 30; length of premaxillæ, 48; vertical diameter of orbit, 26; orbit to gnathion, 87; tooth row to gnathion, 49; length of upper tooth row, 51. Length of horns, straight,  $4\frac{1}{8}$  inches; spread at tips,  $2\frac{5}{8}$  inches. Angle of horns with profile of dorsal surface of head,  $130^{\circ}$ .

Besides the type there are four adult females in the National Museum collected by the Rainey Expedition. Two of these are from Voi, one from Maji-ya-Chumvi, and the other from Mariakani sta-

tion. They all agree closely in their light buffy coloration. The horn character, however, may not be constant as it is based on a single specimen. A large series of the highland races, however, do not show any variation toward vertically directed horns. *Deserti* is a lowland race occupying the Taru Desert and the nyikæ of the coast slope generally as far north no doubt as the Tana River. It differs strikingly from the Athi Plains race described as *hindei* which is a dark tawny form. A series of seven specimens of the latter in the National Museum have been available for comparison with *deserti*. The lowland Nile race, *roosevelti*, is a much smaller and darker colored animal and is readily distinguishable by its small size from all the East African races.

**COLOBUS ABYSSINICUS ROOSEVELTI, new subspecies**

**Mau Colobus Monkey**

*Type* from the Mau forest near Enjoro, British East Africa, adult male, Cat. No. 163261, U. S. Nat. Mus.; shot by Colonel Theodore Roosevelt, December 6, 1909; original number (Heller) 513.

*Characters*.—Resembling most closely *Colobus abyssinicus matschiei* of the Kavirondo country but differing by its smaller size, shorter and more extensively black tail and the presence of a sagittal crest on the skull when aged. From the white-tailed *Colobus* of the Kikuyu Escarpment, the Aberdares, and Mount Kenia it is easily distinguishable by the absence of the large white tail, the white tail tuft being reduced to the terminal one-fourth of the tail, the basal three-fourths of which is clothed by short black hair.

Four specimens of this race shot by Colonel Roosevelt near Enjoro are in the National Museum. These have been compared with a series of five specimens of *matschiei* from the Kakumega forest which are practically topotypes. The skulls of *matschiei* are decidedly larger and their parietal ridges do not unite on the occipital region to form a crest but run parallel and widely separated to their junction with the lambdoidal crest.

No flesh measurements of this race are available. The type skull has the following dimensions: greatest length, 117 mm.; basilar length, 85; zygomatic breadth, 86; post orbital construction, 45; median nasal length, 26.4; width of palate in front between pre-molars, 22; width of palate at last molar, 20; length of upper molar series, 32.5. An adult male of *matschiei* of the same age has a skull length of 127 and a zygomatic width of 92.

The Mau forest near Enjoro where Colonel Roosevelt obtained the types represents the extreme eastern limit of this race. It is primarily a highland race occupying the high forest of the Mau Escarpment. Along the western edge of the Mau Escarpment in the Kavirondo country it meets the race described by Neumann as *matschiei* which is really the lowland Uganda *Colobus* which extends as far east as the Kavirondo district and the slopes of Mount Elgon.

**COLOBUS ABYSSINICUS PERCIVALI, new subspecies**

Uaragees Colobus Monkey

*Type* from Mount Uarageess, British East Africa; adult male, Cat. No. 182138, U. S. Nat. Mus.; collected by Edmund Heller, August 22, 1911; original number 2447.

*Characters*.—The *Colobus* inhabiting Mount Uarageess may be distinguished from typical *Colobus abyssinicus caudatus* of Kilimanjaro by the smaller white tail tuft, longer tail, larger body size and skull. The latter is distinguishable from *caudatus* by the union of the temporal ridges into a sagittal crest. In typical *caudatus* the white tail tuft is of immense size and occupies the whole tail with the exception of the basal one-fourth which is black but in the Uarageess race the whole basal half of the tail is black the white tuft being reduced to the terminal half. In the Abyssinian race, *abyssinicus*, the white tail tuft is still further reduced and is limited to the terminal fourth.

The measurements of the type in the flesh were: head and body, 645 mm.; tail, 645; hindfoot, 190; ear, 38. Skull of the type old with the occipital sutures obsolete, but molars show little wear: greatest length, 102; basilar length, 87; zygomatic breadth, 89; post-orbital constriction, 45; median length of nasal bones, 15; width of palate at last molar, 20; length of upper molar series, 35; length of mandible, 92. Besides the type there is one other specimen, an adult male, from Mount Uarageess in the collection. These have been compared with a series of 17 adult males from Kenia, Kijabe and Kilimanjaro. The largest in this series is exceeded in body size and length of tail by the type. The Uarageess race is confined to the forested summit of Mount Uarageess where it is a rather rare animal. But one troupe of some 20 individuals was noted during a week's sojourn on the northern peak. The forested area of Uarageess is separated from that of Mount Kenia by a hundred-mile stretch of low desert which completely isolates this race from communication with the *caudatus* inhabiting Kenia. Named for A. Blaynel Percival to whom the

describer is indebted for much assistance during his stay on Mount Uaragess.

**COLOBUS ABYSSINICUS TERRESTRIS, new subspecies**

**Lado Colobus Monkey**

*Type* from Rhino Camp, Lado Enclave; adult female, Cat. No. 164756, U. S. Nat. Mus.; shot by Kermit Roosevelt, January 20, 1910; original number (Heller) 623.

*Characters*.—Differs from the other races of *Colobus abyssinicus* by the reduced amount of white in the mantel and the great length of the tail. It approaches most closely in coloration to *matschiei* or *occidentalis* but has decidedly less white in the mantel covering the sides and the rump. The white tail tuft is limited to the terminal one-fourth, the rest of the tail being covered by short black hair. White of tail tuft and mantel much shorter haired than in *matschiei*. Tail greatly exceeding head and body in length. Skull smaller than *matschiei*.

Measurements of the type in the flesh: head and body, 540 mm.; tail, 775; hindfoot, 158; ear, 30. In an adult female of *matschiei* the tail is only 655. The skull of the type is old and has a well-marked sagittal crest on the occipital region: greatest length, 102; basilar length, 75; zygomatic breadth, 72; post orbital constriction, 42.5; median length of nasals, 11; upper molar series, 29; width of palate at last molar, 20.

The type is the only specimen in the National Museum. Small troupes of this race were seen by Kermit Roosevelt near the banks of the Nile, but were not observed by other members of the expedition. They were found in small scattered acacia trees which they deserted when hard pressed and ran across country to the next nearest grove in the manner of baboons. The *Colobus* monkeys of the highlands of East Africa have quite different habits and live in dense forests where they move about through the trees by leaping from one branch to another and descend to the ground rarely to escape an enemy. They are not known to inhabit acacia trees.

**LASIOPYGA LEUCAMPAX MAUÆ, new subspecies**

**Mau Forest Monkey**

*Type* from the summit of the Mau Escarpment between Londiani and Sirgoit, British East Africa, adult male, Cat. No. 173002, U. S. Nat. Mus.; collected by John Jay White, November 1, 1910.

*Characters*.—Resembling *Lasiopyga leucampax neumanni* but dorsal coloration olivaceous (grayish-olive of Ridgway) without the gray cast of that race and with the shoulders more extensively black; body size larger; skull longer and narrower with well-developed sagittal crest in age; teeth larger and heavier.

No flesh measurements of this race are available. The skull of the type measures: greatest length, 122 mm.; basilar length, 87; zygomatic breadth, 77; post orbital constriction, 41; median length of nasals, 26; length of upper molar series, 28; width of palate at M<sup>2</sup>, 21. The skull shows considerable age and has a well-marked sagittal crest running the whole length of the brain case. The cheek teeth and the middle incisors show much wear.

The type is the only specimen in the National Museum, but there is a series of nine specimens of the closely allied *neumanni* from the Kakumega Forest for comparison in the museum collected by the Rainey Expedition. This series which is very uniform smoke-gray on the back exhibits practically no variation in tone and is easily distinguishable from the specimen collected by John Jay White. The largest male in the series has a considerably smaller skull than the type. The race here described occupies the highland forest of the Mau Escarpment and is the easternmost representative of the Congo group known as *leucampax* of which *neumanni* is the lowland Uganda and Kavirondo race.

#### **LASIOPYGA ALBOGULARIS MARITIMA, new subspecies**

##### **Coast Forest Monkey**

*Type* from Mazeras, British East Africa; adult female, Cat. No. 182272, U. S. Nat. Mus.; collected by Edmund Heller, December 17, 1911; original number, 2585.

*Characters*.—*Lasiopyga albogularis maritima* differs from the other East African races by lighter coloration and absence of black lining or black tips to the hair on the back and underparts. Back ochraceous-tawny; underparts light smoke-gray without the blackish vermiculation so prevalent in *kolbi* and *kibonotensis*. Body size somewhat smaller. Skull small with narrow palate and large cheek teeth.

Measurements of the type in the flesh: head and body, 420 mm.; tail, 675; hindfoot, 125; ear, 31. Skull: greatest length, 95; basilar length, 62; zygomatic width, 62; post orbital constriction, 42; median length of nasals, 16; length of upper molar series, 25; width of palate at last molar, 18.



There are three female specimens of this race from Mazeras in the National Museum. The type is fully adult with the sphenoidal sutures of the skull ankylosed but the two others are somewhat immature. This small series has been compared with five females of *kolbi* from the Aberdares and Kenia and five females of *kima* from the Taita Hills. From these two races they are easily distinguishable by their light coloration and absence of black lining to the pelage. *Maritima* is a lighter and somewhat smaller race confined to the forests clothing the summits of the coast hills.

**LASIOPYGA ALBOGULARIS KIMA, new subspecies**

**Taita Forest Monkey**

*Type* from Mount Mbololo, Taita District, British East Africa; adult male, Cat. No. 182242, U. S. Nat. Mus.; collected by Edmund Heller, November 6, 1911; original number, 2555.

*Characters*.—Resembling closely *Lasiopyga albugularis kolbi* of the Kikuyu highlands from which it is distinguishable by its lighter and less rufous back, the smaller extent of the white throat patch and collar and the smaller body size. From *kibonotensis* of Kilimanjaro it is distinguishable by the white of the throat patch extending farther upward on the sides of the neck toward the nape. In this character it is quite intermediate between *kolbi* and the latter, but it is lighter colored and smaller than either of these races.

Flesh measurements of the type: length of head and body, 510 mm.; tail, 600 (defective at tip, perfect tail usually 725); hindfoot, 150; ear, 38. Skull: greatest length, 113; basilar length, 83; zygomatic breadth, 77; post orbital constriction, 44; median length of nasals, 20; length of upper molar series, 27; width of palate at last molar, 22. Skull of type old with the middle incisors much worn and with the temporal ridges uniting at the parietal suture but not forming a high narrow crest.

Ten specimens of this race are in the National Museum collected by the Rainey Expedition upon Mount Mbololo and Mount Umengo of the Taita Hill region. They are confined to the forests at the extreme summits of the hills, and their cover is at present rapidly disappearing before the ax and fire of the agricultural Wataita who are constantly enlarging their fields at the expense of the forest. The Wataita are fond of the flesh of the *kima* and owing to their persecution it is extremely shy and difficult to stalk. The name *kima* is used universally by the Swahili for this monkey and it is also employed by the Wataita who occasionally corrupt it to *gima*.

**LASIOPYGA ASCANIUS KAIMOSÆ, new subspecies**

## Kavirondo White-nosed Monkey

*Type* from the Upper Lukosa River, near the mission station of Kaimosi, British East Africa; adult male, Cat. No. 182371, U. S. Nat. Mus.; collected by Edmund Heller, February 10, 1912; original number, 2692.

*Characters*.—Closely allied to *Lasiopyga ascanius schmidti* of the Manyema and Uganda country from which it is distinguishable by the brighter colored tail which is orange-rufous, the more blackish limbs which lack reddish vermiculation and the general darker and less reddish coloration of the upper parts.

The type measured in the flesh: head and body, 550 mm.; tail, 780; hindfoot, 145; ear, 30. Skull: greatest length, 100; basilar length 68; zygomatic breadth, 68; post orbital constriction, 42; median length of nasals, 16; length of upper molar series, 24; length of mandible, 70; length of lower molar series, 28.

The Rainey Expedition collected a large series of specimens from Kaimosi, the head of the Lukosa River on the lower slopes of the Nandi Escarpment and the Kakumega Forest. This material is now in the National Museum. It represents the eastern limits of the *ascanius* group of *Lasiopyga* in Africa which has not previously been reported so far east as British East Africa. They were found abundant in the dense forests where they lived in proximity to colobus and the large gray forest monkeys, *Lasiopyga leucompax neumanni*. When alarmed they uttered a peculiar, low, chirping, bird-like note very unlike the barking calls of other African monkeys.

**LASIOPYGA PYGERYTHRA TUMBILI, new subspecies**

## Coast Tumbili Monkey

*Type* from Ndi, Taita District, British East Africa; adult male, Cat. No. 182229, U. S. Nat. Mus.; collected by Edmund Heller, November 1, 1911; original number, 2542.

*Characters*.—A very pale desert race of *Lasiopyga pygerythra* having the back olive-buff in color, the limbs grayish and the hands and feet black only on their distal parts. The dorsal surface shows none of the tawny reddish tint so prevalent in the other East African races. From *johnstoni* of Kilimanjaro it may be distinguished by its lighter dorsal coloration and smaller amount of black on the hands and feet. *Rubellus* of the Kenia and Nairobi districts differs

by its darker back which is decidedly ochraceous-tawny and by its wholly black feet and hands as well as larger body size.

The measurements of the type in the flesh were: head and body, 460 mm.; tail, 620; hindfoot, 133; ear, 32. The skull is that of an aged animal with the occipital sutures no more evident and the incisor teeth well worn. The temporal ridges do not form a sagittal crest but the median occipital region is marked by a flattened raised band. Greatest length, 104; basilar length, 70; zygomatic breadth, 70; post-orbital constriction, 44; median length of nasals, 17; length of upper molar series, 26; width of palate at last molar, 18.

A series of 13 specimens of this race is in the National Museum from Ndi, Voi, Changamwe, and Mtoto Andei stations collected by the Rainey Expedition. Most of these were collected at Ndi, a Taita village at the north base of Mount Mbololo. Here they were found living in the acacia trees on the steep sides of the mountain from which they descended daily to the small stream near the village to drink. Others were seen in fig trees growing near the banks of the Voi River close to the station. This monkey is called by the Swahili "tumbili" and the name has been adopted by many of the inland tribes and the resident Europeans for the monkeys of the *pygerythra* group.

#### **LASIOPYGA PYGERYTHRA ARENARIA, new subspecies**

##### **Desert Tumbili Monkey**

*Type* from the Merille waterholes, Marsabit Road, British East Africa; adult male, Cat. No. 182201, U. S. Nat. Mus.; collected by Edmund Heller, July 25, 1911; original number, 387.

*Characters*.—Closely resembling *Lasiopyga pygerythra callida* of Naivasha but separable by the more tawny dorsal coloration, less extensively black feet, shorter pelage and longer tail. From *rubellus* of the Mount Kenia region it may be distinguished by its darker dorsal coloration and lighter colored limbs and tail.

There are no flesh measurements of the type available but a specimen (Cat. No. 182140, U. S. Nat. Mus.) of the race from the base of Mount Uaragess had the following dimensions: head and body, 445 mm.; tail, 650; hindfoot, 129; ear, 33. Skull of type old with worn molars and incisors. Sagittal crest low and short. Greatest length, 99; basilar length, 64; zygomatic breadth, 70; post orbital constriction, 42.5; median length of nasals, 22; length of upper molar series, 24; width of palate at last molar, 18.

Along the banks of the Northern Guaso Nyiro this monkey was found very abundant. It is commonly found in the large flat-topped acacia in small troupes. It is found throughout the desert wherever there is water available. At Merille they came daily to the waterholes to drink but they were quite cautious in approaching the waterholes which were fifty yards from any cover in the midst of the flat sandy riverbed. Besides the type there are 16 specimens from the middle course of the Guaso Nyiro and two from the lower slopes of Mount Uaragess.





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# ANTHROPOLOGICAL WORK IN PERU IN 1913, WITH NOTES ON THE PATHOLOGY OF THE ANCIENT PERUVIANS

WITH TWENTY-SIX PLATES

BY

DR. ALEŠ HRDLIČKA

Curator, Division of Physical Anthropology, U. S. National Museum

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May, eastern



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  - 19-20. The two types of skulls occurring in ancient cemeteries on the coast of Peru. Plate 19 a male and a female skull of Nasca, showing the predominant brachycephalic coast type; plate 20 a male from Chaviña and a female from Chilca, showing the more oblong type, which occurs in minority along the coast, but predominates in the mountains.
  - 21-22. Same four skulls as on plates 19-20, from above.

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23. Ancient cemeteries in Peru, showing the results of the peon's work. The skulls, bones, fabrics, etc., are left to destruction.
24. Parts of three skulls of infants, showing lesions of symmetric osteoporosis. The middle skull is from an ancient burial near Huacho, Peru, while the two frontals on sides are from pre-historic Pueblo cemeteries in Arizona.
25. Adult pre-Columbian male skull from the valley of the Chicama, showing recovery from and the remains of symmetric osteoporosis in infancy.
26. Arthritis deformans of the hip-joint among the ancient Peruvians. Pelvic bone and femur on right from one subject. Femur on left shows early stage of alterations; that in middle represents a very advanced case of flat "mushroom-head," that on right a pronounced *caput penis* condition. All from the Chimu region.

- TEXT FIG. 1. Sketch map of the Lomas, Rio Acari, Sta. Lucia region, roads followed; cemeteries; ruins of more importance; present and old settlements of less importance.
2. Sketch of Huarato, showing approximately the lay and ground-plan of the peculiar ruins of the people with the Aymara head deformation.
  3. The environment of Trujillo and the valley of Chicama. Sketch showing territory covered by the writer and approximate location of a number of the ruins and cemeteries.

# ANTHROPOLOGICAL WORK IN PERU IN 1913, WITH NOTES ON THE PATHOLOGY OF THE ANCIENT PERUVIANS

BY DR. ALEŠ HRDLIČKA

CURATOR, DIVISION OF PHYSICAL ANTHROPOLOGY, UNITED STATES NATIONAL  
MUSEUM

(WITH TWENTY-SIX PLATES)

## I. INTRODUCTION

In 1910 the writer made a brief visit to Peru, resulting in the acquisition of some valuable data and of important skeletal collections,<sup>1</sup> but this gave merely a taste of the anthropological riches of the country and created a strong desire for further work in that part of the South American continent.

An opportunity to extend the investigations was afforded the early part of the year 1913, in connection with the preparation of anthropological exhibits for the Panama-California Exposition at San Diego; and three busy months were spent on the Peruvian coast and in certain parts of the mountain region of Peru, in exploring the ancient cemeteries.

Due to adverse climatic conditions, poor means of communication and transportation, the backward state of the people, and the prevalence of infectious diseases, the journey proved uncommonly difficult. For these reasons and also because of the impossibility of further extending the absence from Washington, it became necessary to limit the territory to be covered. Notwithstanding these conditions however, much was learned, while a large number of the rarer specimens were gathered for further study.

Before proceeding with the account of what was accomplished, grateful acknowledgment should be made to the Peruvian authorities and to good friends in different parts of the country, for the generous help extended to the expedition. The writer wishes espe-

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<sup>1</sup> Reported by the writer in "Some results of recent anthropological exploration in Peru," *Smithsonian Misc. Coll.*, Vol. 56, No. 16 (Publication 2005), Washington, 1911, pp. 1-16, with 4 plates.

cially to thank His Excellency the President of Peru, who personally granted the needed permits for the exploration; to Sr. Luis Felipe Paz Soldan, the Director de Gobierno, who assisted the writer with the permits and in other matters; to the Hon. Ministro de Fomento, and the Srs. Ingenieros José Bravo and C. W. Sutton, who rendered valuable aid in more than one direction; to Mr. H. Clay Howard, the U. S. Minister at Lima, who gave much official and friendly aid with the Peruvian authorities; to W. R. Grace & Co., both at New York and at Lima, who helped the expedition very materially with introductions and in facilitating the transport of the collections; to Sr. Miro Quesada, editor of "El Comercio," for his kind recommendations to the President of Peru in regard to the expedition; to the excellent friends, Senator Sr. Victor Larco, of Trujillo, and Sr. Enrique Fracchia, of Lomas, without whose generous aid a large part of the work in the Chan-Chan and the Nasca regions could not have been accomplished; to the family Tello, of Huarochirí, to the members of which the writer is indebted for many favors; and last but not least to Messrs. Otto Holstein and R. H. McGeary, officials, respectively, of the Central and North Eastern Peruvian Railroads, who assisted with transportation and in other directions. And these names by no means complete the list of those who unselfishly helped in one way or another toward the success of the trying work.

The principal objects of the trip were, to determine, as far as possible, the anthropological relation of the mountain people with those of the coast; to make further studies regarding the distribution of the coast type; to determine the type of the important Nasca group of people; and to extend the writer's researches on Indian and especially pre-Columbian pathology. Advance was made along all these lines, although the limits or final words were not reached in any case. The earlier conclusions of the writer were in the main corroborated, but the new facts add details and show exceptions. With regard to the mountain regions, much remains for future determination. As to the pathology of the native Peruvians before contact with the whites, the main work can perhaps now be regarded as done, or nearly so, though individual variation in different morbid processes seems inexhaustible, and much in this line will doubtless appear in further collections.

The total skeletal material examined on this journey was enormous, the collections alone filling over 30 cases. No excavation, however, was undertaken, attention being restricted, on the coast, to the

bones upon the surface of ancient cemeteries, exploited by the peons and occasionally by persons "higher up" for the sake of the pottery and other valuables buried with the bodies; and to the usually equally exploited burial caves or houses in the mountains. This procedure was necessary on account of the limited time available for the journey, as well as to comply with the terms of the official permits. It had the unequalled advantage of enabling the writer to examine an immense number of specimens. This made it possible to learn promptly many facts offered by the material, and to make representative collections in a relatively short time. These precious and now rapidly disappearing opportunities present, however, also certain disadvantages which can be compensated for only by patient and prolonged excavation. They render difficult and in many respects impossible, any exact statistical determinations, and only rarely do they give opportunity to examine all the parts of the individual skeleton.

As heretofore mentioned the opportunities for anthropological and pathological studies on the prehistoric material in Peru are on the wane, and should be taken full advantage of before they are largely lost, which is seemingly a matter of only a few years. In 1910, after the writer returned from Peru, he called the attention of the Anthropological Society of Washington to the vandalism going on unrestrainedly in the richest burial grounds and ruins of that country, and a resolution was adopted by the Society calling the attention of the Peruvian Government to the necessity of stopping this wanton destruction.<sup>1</sup> As a result, a set of rules was promulgated by the president of Peru prohibiting unauthorized excavations and exportation of archeological specimens from the republic.<sup>2</sup> These rules were published and communicated to the various Peruvian authorities concerned in the subject and while they failed to accomplish their full purpose, yet they have diminished the excavations to a very large extent, and have especially made the peon wary, so that in many instances he now hides the traces of his work by covering the bones. Meanwhile the destruction by the elements of the skeletal remains left on the surface is rapidly advancing, so that cemeteries that were still rich in such material in 1910, to-day, in many cases, offer little more than useless rubbish. The laws against the destructive work of the peon will doubtless be more fully enforced

<sup>1</sup> See *Science*, 1911, p. 552; *The American Anthropologist*, 1911, p. 317.

<sup>2</sup> Edict of August 11, 1911, published in the *El Comercio* and other Peruvian periodicals; translation in *The American Anthropologist*, 1912, p. 204.

in the future, as they should be, and four or five years hence, except in the mountains and the more sheltered localities, but little will be found in Peru for the anthropologist without costly and time consuming excavation.

## II. EXPLORATIONS IN THE SIERRAS: REGION OF HUAROCHIRI

The rugged, high, mountainous district southeast of Lima, known as the province of Huarochiri, is entered either from the line of the Central Peruvian Railroad, or by a detour from the coast. The former route involves the passing through localities infected with dangerous diseases peculiar to certain parts of Peru, the *uta* and especially the *verruqa*, as well as some long and steep ascents. The other route passes through a healthier territory, but means two to three days arduous journeying, devoid for the most part of all accommodations for man and beast.

The Huarochiri region has no special historical importance, and, although so near to Lima, it has never been well studied archeologically or anthropologically; but it has long been known to be relatively rich in ruins and in trephined crania. Some of the trephined skulls found their way into the remarkable collection described 15 years ago by Muñiz and McGee,<sup>1</sup> and two years ago the Harvard Medical School purchased a large number of similar specimens from Dr. Julio C. Tello, a native of the town of Huarochiri. The latter collection, as yet undescribed, was made by Dr. Tello, with the assistance of Dr. Clemente Palma and some of the natives, entirely in the district of Huarochiri, and when seen by the writer was found not merely to present highly interesting conditions from surgical and pathological standpoints, but also to show crania of a remarkably uniform type such as occurs only exceptionally in the coast regions. These facts and the problems they offered made a personal investigation of the burial places of this district very desirable. After duly obtaining permission from the Peruvian authorities, the writer therefore started at once toward Huarochiri.

Preceded by a brief visit to the ruins of Cajamarquilla, the route chosen was that by way of Matucana, whence a perilous and long day's journey took the writer, with a soldier-companion and a native, to San Damian, the center of a difficult but archeologically

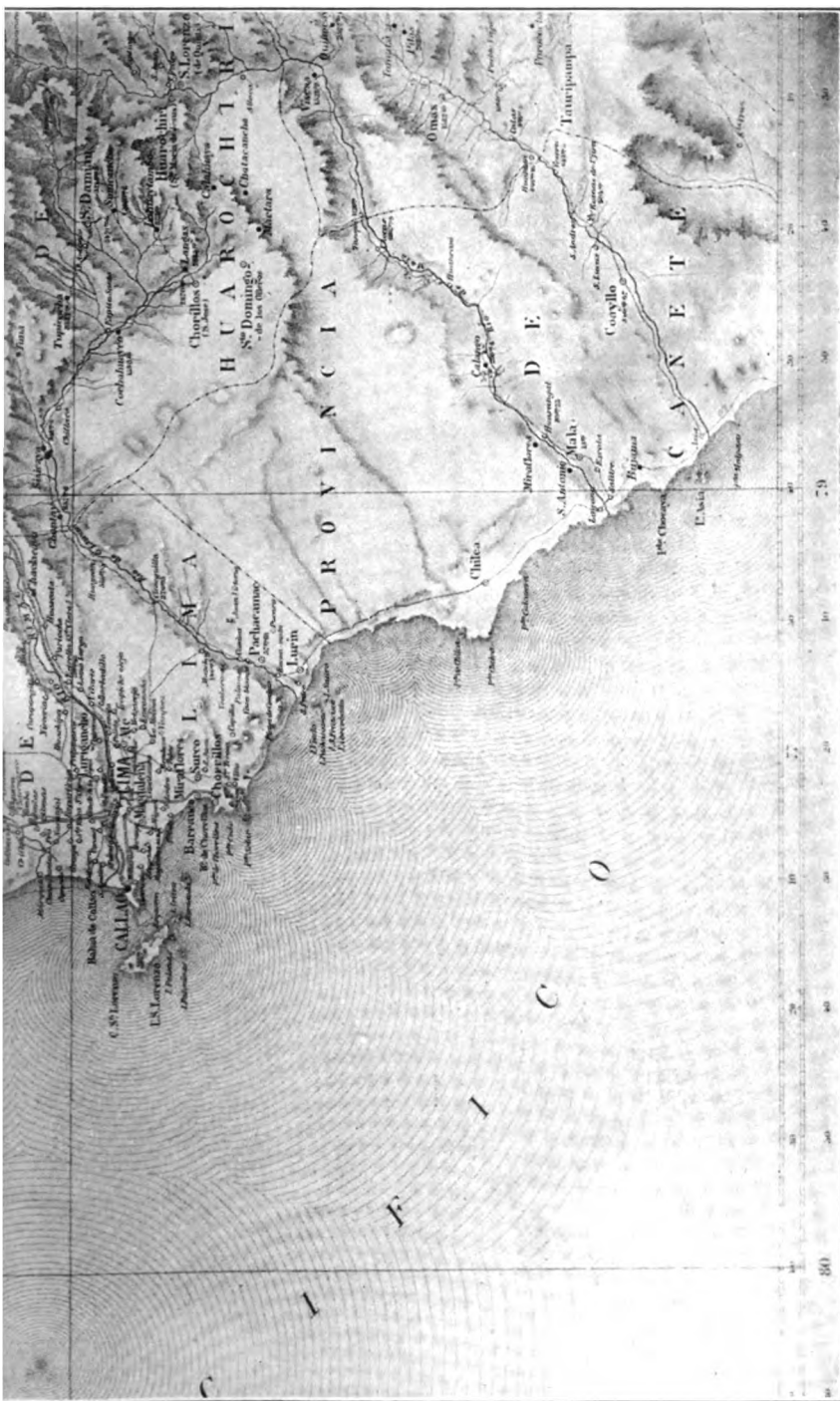
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<sup>1</sup> Muñiz, M. A., and McGee, W. J.: Primitive Trephining in Peru, 16th Ann. Rep. Bur. Amer. Ethnol., Washington, 1897.









MAP (AFTER RAIMONDI), SHOWING THE CENTRAL PARTS OF THE PERUVIAN COAST, AND THE PROVINCE OF HUAROCHIRI.



rich region, from which shorter trips were undertaken in several directions. At San Damian, Dr. J. C. Tello, who had been appointed by one of the ministries as a companion, met the writer, who with him proceeded to Huarochiri, whence again a number of trips were made into the neighborhood. Then, with the rainy season making further travel in the mountains out of question, our small party returned by the more southern route to the coast. The rapid observations made on this journey under difficult climatic and other conditions were as follows:

*Cajamarquilla*.—The extensive ruins known by this name lie in a nook of the foothills rising at the northern limits of the Rimac Valley, approximately 18 miles east of Lima, and about five miles from the little station of Santa Clara on the Peruvian Central Railway. They have not as yet been thoroughly investigated, though partially explored by Squier,<sup>1</sup> Middendorf<sup>2</sup> and Uhle<sup>3</sup> and visited by Dr. Charles W. Currier,<sup>4</sup> Mr. M. H. Saville and other archeologists. According to Squier's estimate, the ruins cover nearly a square league. The structures are all of adobe, and have suffered considerably from climatic conditions and earthquakes. They are not very imposing, but their extent shows that the city must have harbored at one time a very numerous population. Contrasted with this is the relative scarcity of cemeteries. Burial grounds, one large and one small, have been located just south of the ruins on the plain and one exists on the top of a hill to the north. There seems but little chance that any extensive burial grounds have thus far escaped notice, and these cemeteries together are so disproportioned to the probable population of the town, that, as cremation or distant burials were not practiced, there seems to be only one explanation for these conditions, namely, a rapid building and a brief occupation of the town. No historical mention of the place is known; a vague tradition in the valley ascribes the town to the "reconcentrados" during the early part of the Spanish dominion, while Uhle found that the archeological contents of the graves represent several cultures. The writer led by the *dueño* of the hacienda Nieveria, to which these lands belong, visited the two cemeteries on the plain, found numerous skulls

<sup>1</sup> Squier, E. George: Peru, etc., 8vo, New York, 1877, pp. 91-97.

<sup>2</sup> Middendorf, E. W.: Peru, Vol. 2, Berlin, 1894, p. 74.

<sup>3</sup> Uhle, Max: Ueber die Frühculturen in der Umgehung von Lima. Trans. Intern. Congr. Americanists, Wien. 1909, p. 362; also a map (No. 2, Distribution de las Varias Civilisaciones en el Valle de Lima), Lima, 1907.

<sup>4</sup> Currier, Charles Warren: The Dead City of Cajamarquilla. Bull. Pan-American Union, Washington, August, 1912, pp. 301-308.

and other skeletal remains on the surface and also some open graves in the form of deep adobe-lined cists, resembling considerably the stone cists encountered farther south, in the Nasca and Acari valleys. The bones indicated a homogeneous population of medium stature and strength. The skulls were almost invariably brachycephalic, of the coast type, and usually free from the characteristic artificial antero-posterior deformation so common in prehistoric times on the coast, but which disappeared soon after the coming of the Spaniards. A few that showed the fronto-occipital flattening showed it in a small degree only. These facts would seem to speak for a rather recent, post-Columbian, period for these ruins and burials.

Fifteen miles eastward of Cajamarquilla, in the now rough and narrowing valley of the Rimac River, lies the health resort Chosica, and, according to information obtained, skeletal remains of the mountain population, with a few trephined crania, have been found in the hills to the north as well as to the south of this locality.

From Chosica the canyon ascends at an increasing grade to Matucana, passing through what is probably the most dangerous verruga region in Peru. Signs of ancient occupation in the form of terraced fields on the slopes of the mountains appear in many localities, and the natives tell of ruins and burial caves in the sides and especially on the tops of the scarcely scalable great rocky hills. Here for the first time the rather puzzling fact was met with—seen later on to be the general rule in these regions—that the ancient settlements and burials are found not in the scanty lowlands, but near or at the summits of the less extreme mountains.

Opposite and north of the village and station of Surco, 56 miles from Lima, a huge mountain rises, known as the "Cerro Wacapuna," the summit of which is reported to show remnants of a large, ancient fortification, and a subterranean cavity with burials.

*Matucana* itself is a small town situated 64 miles east of Lima at an elevation of 7,800 feet, in a narrow part of the "quebrada," of the Rimac, and is surrounded on all sides by mountain masses that reach several thousand feet higher. In the great elevation which dominates Matucana on the south there were said to exist some burial caves, and a number of apparently more important localities with ruins and burial caves were reported to exist in the rough country to the northeast of Matucana. Due to the presence of the verruga in this region, personal exploration of the various remains was not undertaken, but an arrangement was made with

Sr. Lizardo Montes, an ex-prefect of the district of Huarochirí and a 20-year sufferer from the dread "wart" disease, for a collection of skeletal material. The results were about 30 crania and a box of other bones of the skeleton. Sr. Montes reported that all the sites examined have been found despoiled by those who hunted for valuables, and in many instances the skeletal remains had been thrown out from the caves and were found broken and more or less decomposed on the side of the mountain. Of the 30 crania collected, one showed trephining. None of them presented any deformation, and a large majority belong to the same oblong type as that represented in the Huarochirí collection at Harvard.

*San Damian* was found to be a fair-sized and picturesque village situated on the shoulder of a mountain, at an elevation greater than that of Matucana and probably not far short of 9,000 feet (pl. 2, fig. 1). The place is surrounded on all sides by mountain masses and peaks, separated by more or less deep "quebradas." Washing the foot of the promontory on which the village stands winds a branch of the Rio Lurin. The summits of the mountains rise from 10,000 to over 13,000 feet in height, and many of the lower ones show ruins, ancient fortifications, or burials. The canyons are for the most part so narrow, unhealthy and difficult of penetration, that the ancient inhabitants of these regions were obliged to search for more favorable spots on the heights; they terraced the fertile mountain sides for fields; they fortified some of the more inaccessible summits; and they buried in caves, crevices or rock shelters, which were walled up when no more used, or in peculiar long low stone houses, constructed near the settlements and on high elevations in the neighborhood. The present inhabitants (pl. 5, fig. 1), all of whom are of mixed blood, but some of whom doubtless descend from the former Indians of these regions, have taken the terrace fields as a heritage and continue their cultivation in what is probably the old manner (pl. 2, fig. 2; pl. 5, fig. 2). Such "andenes" are found in all parts of the district of Huarochirí, at various localities in the canyon of the Rimac, and in all neighboring territory as well as in a great many other parts of the mountainous regions in Peru. They are often exceedingly picturesque, with their well-made supporting walls, green-lined acequias, rich black earth, and fresh crops of corn, alfalfa, wheat, or potatoes.

There are indications that at the time of the conquest, or just before, the population of this territory was larger than at the present time. The cultivation of the difficult terraines, it is seen, was more

extensive and the region is full of ruins. The latter can be found on or near all the summits where water could be had and where some of the steep slopes in the neighborhood could be terraced.

The writer's stay at San Damian was too brief for a thorough survey of the ruins and he can only report upon them collectively. The nearest are known as Pueblo Viejo. They top a hill less than two miles northeast of San Damian, tapering toward the east and northeast. Farther on in the same direction, on the steep slope on both sides of the road to Toctococha, are numerous burials in shallow caves and under the rocks. On a large hill to the north of that of Pueblo Viejo and across a canyon, is another ruin; on the mountain beyond that still another, and the same applies to the great ridge that extends northwestward. To the south and southeast, there are several ruins, one, like Pueblo Viejo, partially in view from San Damian. Directly to the east a huge mountain blocks the way, but to the westward appear the "Cinco Cerros" or Five Peaks, a remarkable stone fortress and an important burial ground (pl. 2, fig. 2), while still farther west, near Tupicocha, are the ruins of Sunaikaka (recently visited by Dr. Tello), and to the south there are said to be remains of still other old settlements.

The region would well repay a three or four months exploration in a favorable season. The writer had only ten days and most of this time it was a work of traveling in clouds or chilly drizzle. He did not suffer from the soroche, or mountain sickness, which incapacitates so many in these altitudes; nevertheless the climbing of the steep slopes, to reach the ruins or burials, was attended by considerable difficulty in breathing and a continuous effort for more than three or four minutes was impossible. A piece of the rough ground would be scaled, until the lungs would threaten to burst, when it would be necessary to lean on some rock for several minutes until more normal respiration was reestablished; then the procedure would be repeated. Nor were these the only difficulties. Serious obstacles were encountered on the part of the natives, ignorant, superstitious, unwilling, and enfeebled by alcohol. Reliable information or help was out of question; and due to the general poverty and the season, it was almost impossible to secure the necessary animals, or food for them when secured. Notwithstanding, visits were made daily to ruins and fair collections were obtained from the Pueblo Viejo, Ullulla, and especially from the "Cinco Cerros." And the exploration would have been prolonged had it not been found that the majority of the more approachable ruins had been





Fig. 1. San Damian, with the clouds rising from the "quebrada" just beyond

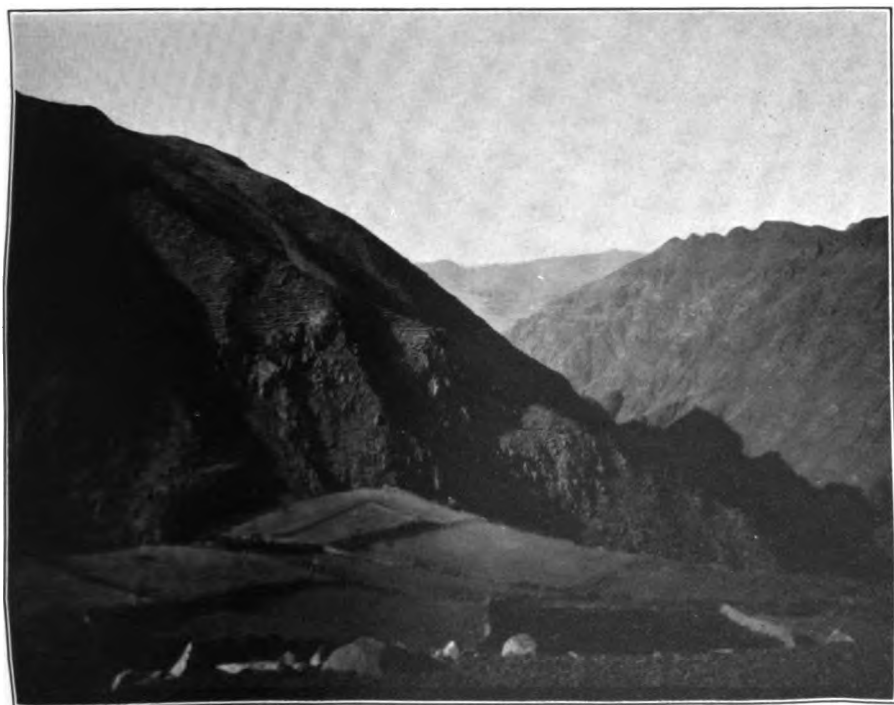


Fig. 2. "Cinco Cerros" ("five peaks") from just beyond San Damian. On the steep slopes in the foreground to the left, some "andenes" or terrace fields

THE VILLAGE OF SAN DAMIAN AND THE OLD FORTRESS "CINCO CERROS"



**Fig. 1. Ruined stone burial houses on a rocky promontory opposite the ruins known as Pueblo Viejo, near San Damian**



**Fig. 2. Stone burial houses higher up on same rocky ridge as those shown above  
OLD STONE BURIAL HOUSES NEAR SAN DAMIAN, DISTRICT OF HUAROCHIRI**

visited by Tello or his native friends, who secured whatever seemed more valuable of the skeletal remains for the collection that was later sold to Harvard. The "Cinco Cerros" have fortunately escaped, though, like nearly all such locations in Peru the remains were despoiled by the treasure hunters; and the writer found here some precious cases of trephining as well as some interesting anthropological material.

The results of the exploration about San Damian cannot be fully given before the elaboration of the collections. A number of the most evident facts, however, are as follows:

The region was settled predominantly by people with a more oblong type of skull, the same as has been found in the neighborhood of Matucana and which has before been seen in the Tello collection from the district of Huarochiri. Besides this, however, there were also found remains of what may have been clans in some of the settlements, with a more brachycephalic type of crania approaching those of the coast. At the "Cinco Cerros" ruin, the remains of the individuals of this type, who were in minority, occupied one separate burial house.

The long and other bones showed that throughout the region the people were well-built and of fair stature. Also they were a people remarkably free from such constitutional diseases as would leave marks on the bones, for pathological specimens among the latter were very scarce. Injuries of the various parts of the skeleton were also rare, but on the other hand wounds of the skull were common. These wounds were evidently due in a large majority of the cases to sling shots and clubs, and often when the injury was not immediately fatal, the subject would be operated on by trepanation.

The peculiar burial houses met with in this region and later on in other parts of the district of Huarochiri, deserve a special mention (pls. 3 and 4). They are structures from 8 to over 30 feet long, about three feet inside and five and one-half feet in outside diameter, with walls approximately four feet high, and a flat or a low A-shaped roof rising from one to two and one-half feet higher. Few of those seen may have exceeded somewhat these dimensions. The walls where finished are generally seen to have been quite well-built of unhewn stones. They were covered by big slabs reaching from side to side, and on these were placed flat stones in an offset manner in such a way as to form sort of eaves on each side and rise to a convex or a bi-sloped roof. The interstices among the roof

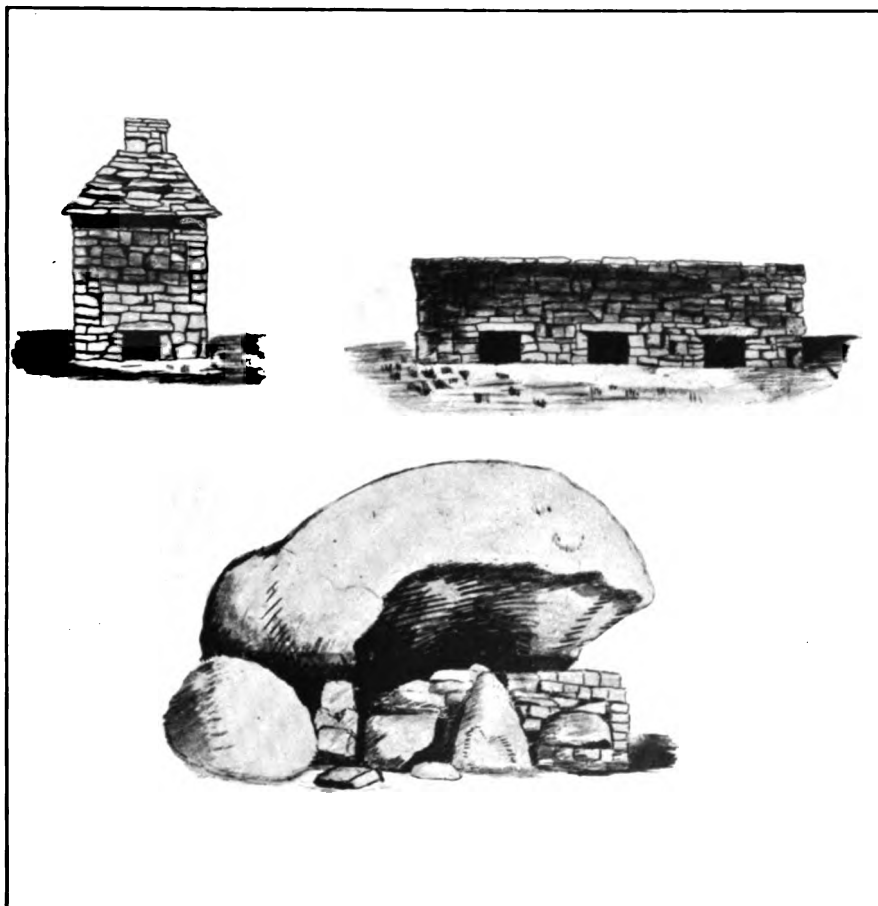
stones were filled with earth, and sometimes the whole surface of the stone roof was evidently covered with earth or sod. In some instances the roof was left very low and quite flat, but in others the A-shape is well marked. In one of the sides there would be, at the level of the ground, one, two or even three doorways, according to the size of the house, through which a man could just crawl. Some of the longer houses were divided into two and even three compartments by a secondary stone wall on the inside, and the floor was generally lowered below the level of the outside ground.

These burial houses, as well as burial caves, often served for secondary communal burials, but besides this, individual bodies were also placed in them in the contracted position, and in some instances, as later seen near Huarochirí, all of the burials in a given mortuary house might be of this nature. The bones or bodies were placed close together and scantily covered with earth up to the level of the outside ground; above this they were evidently laid in without any covering.

Some of the largest burial houses seen at the Five Peaks each contained the remains of over one hundred individuals, while the smallest ones might not shelter the bones of more than two or three bodies. None were found filled to their capacity, and a few were almost empty. Their position and arrangement seldom showed anything noteworthy; at the "Cinco Cerros" however, there existed in the midst of a group of such houses a moderate-sized square, which may have served for ceremonies, and one isolated burial house at the same place was found surrounded by a circle of single larger stones. When a burial house was no longer used—and the same is true of the burial caves—the doorways (or mouth in the case of the caves) were walled up.

These stone houses seem to the writer to be nothing but modifications of the well-known chullpas found in the highlands farther eastward, and this opinion was corroborated by what has since been found by Drs. Tello and Cl. Palma in another part of the district of Huarochirí (pl. 4). They show various modifications in different parts of Peru (pl. 18) and, modified by environment, they become the stone or adobe burial chambers or pits found in some parts of the coast region.

*Huarochirí* (pl. 5, fig. 2).—From San Damian the writer proceeded, through a territory less rich in and in some parts wholly devoid of ancient remains, to the valley of Huarochirí. This with the neighboring elevations was found to be a beautiful and picturesque



BURIAL TOWER, BURIAL HOUSE, AND WALLED-IN ROCK-SHELTER FOR BURIALS; RUINS IN THE SIERRA DE HUACHUPAMPA, DISTRICT HUAROCHIRÍ, NORTH OF MATUCANA

(From a drawing by Dr. C. Palma, furnished by Dr. J. C. Tello)



Fig. 1. Natives, all mixed bloods, of San Damian, Dept. of Huarochiri



Fig. 2. The town of Huarochiri, with San Pedro and the Cerro de San Pedro in the rear. Andenes on the slope of the mountain

NATIVES OF SAN DAMIAN AND THE OLD TOWN OF HUAROCHIRI

region, even richer in ruins and other remains of the past than San Damian. The ruins exist in every direction from the present town, and several of them represent large ancient settlements. This is especially true of those on the hill overlooking Huarochirí on the north, those occupying the surface of a low, long mesa about three miles down the valley, and some to the southeast, at some distance from San Pedro. A number of the ruins on the north side of the river were examined by the writer in company either with Dr. Tello or the gobernador of Huarochirí. Those of the two large settlements mentioned above, that to the north and that down the valley, showed the remains of numerous stone walls of houses, enclosures and terraces, with a series of formerly walled-up burial caves (pl. 6), and of half ruined and now empty burial houses. The habitations were built throughout of moderate-sized uncut stones, and with a few exceptions the workmanship was rather mediocre.

More interesting conditions were found at a locality known as Lupo, situated on the northern slopes of the valley about 10 miles up the river Rio Mala from Huarochirí. There were no ruins of dwellings, but numerous burials existed under some huge boulders strewn over the slope; and farther up, at a distance of a few hundred yards, in a range of scarcely approachable rock shelters, there were over a score of burial houses, looking very much like cliff dwellings.

A most interesting group of these houses was encountered on the second visit to the locality. After a perilous descent, before which the natives provided themselves with ample quantities of coca and cigarettes, supposed to antagonize the injurious effects resulting from the showing and especially handling the old human remains, we reached, partly with the help of a lasso, a long narrow shelf in the nearly vertical rock cliff, and there in the shallow shelter found a row of nine burial houses. The fundamental characteristics of these were the same as in the case of those about San Damian, but they were shorter, higher, divided by cross slabs into two stories, and with flat roofs made of stone slabs and earth. The walls were well constructed of uncut stone. Between the three more proximate and the six more distant houses, there was an interval behind and above which the wall was much blackened by fire; and on the wall above the house, well out of reach, were seen large marks in red, plainly made by the aborigines. Under these unintelligible marks in one place was a cross, with a lower branch longer than the three others, as among the Catholics, traced by pigment like that used in the large painted symbols or figures above the

houses, and probably contemporaneous. This makes it possible that these particular burials date from the early era after the Spanish invasion. Nothing was found with the bodies that would demonstrate a contact with the whites, but this cannot be regarded as a proof that the burial place was pre-Columbian. There can be no question but that numerous burial places, both in the mountains and along the coast, are post-Columbian, for the natives did not disappear immediately after the whites came, nor did they at once give up their old cemeteries or methods of burial; and a large majority of them doubtless died in the earlier times after the Spanish invasion without any chance to acquire such articles of white man's manufacture as would be interred with them and persist to the present time.

The burial houses now visited, though in better condition than those of similar nature seen lower in the Huarochirí Valley, nevertheless also showed the effects of marauders. Not one was intact. The walls and especially the ceilings were in many places broken down, and many of the bones and mummies that originally, according to all accounts, existed here, had doubtless been thrown over the cliff and lay broken in fragments below. Nevertheless, a number of naturally preserved mummies with crude wrappings were still encountered, as well as a considerable quantity of bones and upward of 30 crania, one of the latter showing a remarkable example of trepanation by scraping. This ruin yielded, besides the skeletal remains, a few gourds, some decorated by burning; several rawhide sandals, almost identical in style with those still used by the common people in these regions; and a "liburi" or "bola," a lasso with three irregular and rather small but heavy metal balls, a weapon much like that used by the Patagonians. Among the bones was a humerus showing a clean amputation, which, as amputation of bones was unknown to the prehistoric Indian, strengthens the supposition that these burials were post-Columbian.

On the whole the exploration in the environs of Huarochirí, which regrettably was soon terminated by the advancing rainy season, showed the following:

In pre-Columbian and probably the early Spanish times the region was thickly peopled. But the inhabitants were evidently for the most part poor and had not made much advance in architecture or in other lines of material culture.

Anthropologically, the people of this region show again two cranial types, the more oblong one, which seems to be characteristic of a



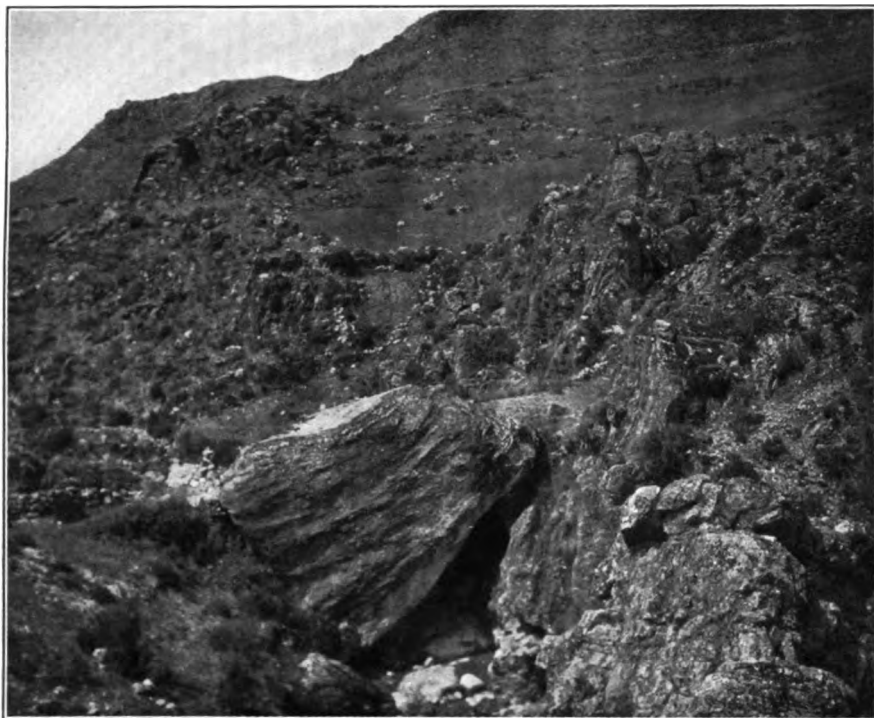


Fig. 1. Burial hole; ruins above



Fig. 2. Burial cavern, amidst ruins

BURIAL HOLES AND CAVERNS AMONG AND IN THE VICINITY OF RUINS COVERING A LARGE PART OF THE TOP OF A MOUNTAIN JUST NORTHWEST OF HUAROCHIRI



large part of the central western sierra, and a more rounded one, related and possibly identical with the prevailing type on the coast. In some of their ruins, one of these types is seen to predominate and in others the other, but in most instances there is also present some mingling and probably intermixture.

Artificial deformation of the head has not been practiced by any of the people of the Huarochirí Valley; rarely, however, a skull will be found showing the circular or "Aymara" compression and one specimen was brought from some distance with a typical fronto-occipital flattening such as met with along the coast.

As in the neighborhood of San Damian, the people were rather well built, with good though not excessive musculature. Remains of very tall and again very short individuals were not met with. Diseases, at least such as would leave marks on the skull or bones, were very scarce and the same is true of injuries, except those of the head. In regard to the latter, fractures of the skull ranging from small impressions to a complete fragmentation were quite common, as about San Damian. There doubtless had been considerable fighting in the entire district of Huarochirí. Some broken skulls also indicate falls down the precipices.

Wounds of the head frequently were treated by trepanation, and this was often successful; but the local medicine men were evidently not well versed in the treatment of fractures of the long bones or other surgical procedure.

The exploration in the entire district of Huarochirí demonstrates, on the whole, the prevalence in these mountains of a type of Indian differing physically as well as culturally from that common to the coast. The identity and the connections of this interesting, handsome, oblong-headed type remain to be determined. As will be seen later on, there are indications that this type reached much farther to the north as well as to the south. These people may have been related to but were not tribally identical with the "Aymara" as we know them from Bandelier's collections.

Besides the above, there is found at some points in this district a small, and at others a moderate intrusion of more round-headed people, probably related to the coast people, but not practicing head deformation. The skulls of this type cannot be regarded merely as modifications of the more oblong variety, because they are not infrequently found in a burial cave or house where none or but a few skulls occur of the other type. Exactly what they represent is another problem for the future.

### III. EXPLORATIONS ALONG THE COAST NORTH OF LIMA

*Ancón*.—Due to its accessibility from Lima, the large cemetery of Ancón has been visited, explored, and described more than any other single burial ground in Peru. Notwithstanding this it is still fairly rich in material, some of which throws additional light on the people and conditions of the region.

The first effects of the view of this cemetery on the writer, who was led from the report of the place to expect something extraordinarily extended and interesting even for Peru, were rather disappointing. It cannot compare with the burial grounds of Pachacamac, Chan-Chan, and other localities. Also there are no ruins near by. There are in fact no signs of any settlement in the vicinity with the exception of the refuse heaps within and near the present small town.<sup>1</sup>

The surface of the cemetery was rather poor in material, especially such as would be fit for examination. A good many of the skulls, were found broken by stones—one of the amusements of the Ancón excursionists. On close examination and repeated visits, nevertheless, a number of interesting specimens were discovered.

The refuse heaps are composed mainly of shells and contain an occasional burial. There seems no reason why they should be regarded otherwise than as contemporaneous with the cemetery, for they are neither so great nor so diversified as to indicate a different age.

As to the cemetery itself, there are indications that some parts of it are older than others, and the graves nearer the railroad tracks to Lima seem post-Columbian. The older burials yield bones that are freer from remains of the soft parts and skulls that generally show a marked fronto-occipital flattening. In the more recent and generally more superficial graves, more flesh remains on the bones, the skulls are frequently undeformed or show but moderate antero-posterior flattening, and the bones on the whole are fresher and more resistant. Notwithstanding the differences in age of the burials, however, the Ancón skulls are all or very nearly all the same type. They are the brachycephals of the coast; the rare exceptions belong to the oblong type such as found in the mountains. Also, the bones of all ages at Ancón indicate about the same stature of the people, which was rather moderate, and, for the men at

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<sup>1</sup> See in this connection Uhle, M.: *Die Muschelhügel von Ancón, Peru*. Trans. 18th Int. Congr. Americanists, 1913, Vol. 1, p. 22, et seq.

least, a very good development in strength. There was at no time any intrusion of foreign people. The cemetery is evidently that of the fishermen of the Ancón Bay and has in all probability been used from the time of their coming to the locality up to historic times.

A number of peculiarities worthy of special mention were met with in this burial ground. The very first skull picked up showed a small impressed lesion and an unfinished trephining by the rare method of boring. Curiously, no other case of trephining was discovered at Ancón. In a superficial grave near the middle of the cemetery and wrapped in native articles of clothing, lay the still partly connected skeleton of a young woman, who was killed from behind by being struck on the back of the head with a club or a large stone, and with her lay uninjured the body of her infant, possibly put to death in some manner because of the decease of the mother.<sup>1</sup> Finally, there were found here relatively numerous cases of exostoses in the meatus auditorius, of symmetric osteoporosis of the skull,<sup>2</sup> and of "mushroom head" femora (arthritis deformans).<sup>3</sup>

*Huaral.*—A little over a year ago an extension of the railroad line was constructed from Ancón to Huacho and Sayan. The line, after passing over the arid and sterile pampa of Ancón and the sandy hills farther on, descends to the fertile low flats of Chancay and Huaral. This region contains numerous remains of aboriginal population, including some cemeteries. The villages were of adobe, worked in the form of large, heavy blocks; but there are also remains of habitations made of reeds or totora (cat-tails).

One of the more important ruins was examined. It is situated about eight kilometers southwest of Huaral, at the base of a rocky hill. The structures were all built of big adobe blocks, resembling in this respect very closely those of some of the ruins in the Lima Valley, especially in the neighborhood of Chorillos. The ruin is in a poor state of preservation and has been much excavated by the peons of the neighboring haciendas. Notwithstanding the usual reports of "montones" of bones, only a small number of skeletal remains were discovered. The skulls showed antero-posterior compression, as usual along the coast, and evidently represent the same people as those of Ancón. Two similar skulls were seen in other localities of the valley.

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<sup>1</sup> Among the North American Indians, as well known, a child at breast was not infrequently buried with the dead mother.

<sup>2</sup> See Appendix.

<sup>3</sup> See Appendix.

*Kilometer 98.*—After passing Huaral, the railroad line soon enters again the desert depressions and hills, which extend to the valley of Huacho. In constructing the line over a barren elevated flat facing the sea, 98 kilometers from Ancón, the workmen struck an old graveyard, which they promptly set to excavate, and which yielded quantities of pottery with many human bones. Due to the kindness of Mr. Otto Holstein, the chief of traffic of the railroad, the writer and his companion for the time being, Dr. Tello, were "dropped" off at this hot and desolate place one Saturday noon, and stayed there until the afternoon of the following day. The place was found littered with pottery as well as human bones (pl. 7). Probably more than 200 burials had been excavated. There were no ruins nor any signs of habitation in the neighborhood, with the exception of three or four mealing stones among the sands a little to the south and some shell accumulations; nor were there any ruins within a considerable distance in any direction. The place was evidently a settlement of fishermen, and was occupied only during certain portions of the year. The cemetery, which is not completely exhausted, was very rich in pottery, from two to as many as ten or more vessels being found with each body, as we learned later on. The earthenware represented in the main kitchen utensils and tall water jars, but there were also other types. It was well made and in numerous instances quite artistic in shape or decoration, though scarcely comparable with the better class of Peruvian pottery.

The vandalism in this place was appalling. Hundreds of vessels which could not readily be sold or transported, lay broken and even entire over the surface, and skulls and bones, in many instances damaged by the diggers, lay in every direction. A busy afternoon was spent in examining the remains and selecting what was worth saving; a cache was made of the entire or better preserved pieces of pottery (pl. 8, fig. 2), and a valuable selection of skulls and bones were packed in sacks and eventually brought to Lima.

That night we were to be taken away by a "train," but the train proved to be only a machine and this passed serenely by leaving us where we were. We, therefore, slept on the sands. The next morning, Sunday, our first occupation was a dangerous descent down a steep slope to the sea, more than 200 feet below, for a bath. When we returned an hour later, we found to our astonishment five men busily engaged in digging in the graves (pl. 8, fig. 1), and at the same time saw a railroad hand car on which they came. They



Fig. 1. Waste of pottery, skulls and bones. A party of peons excavating farther on

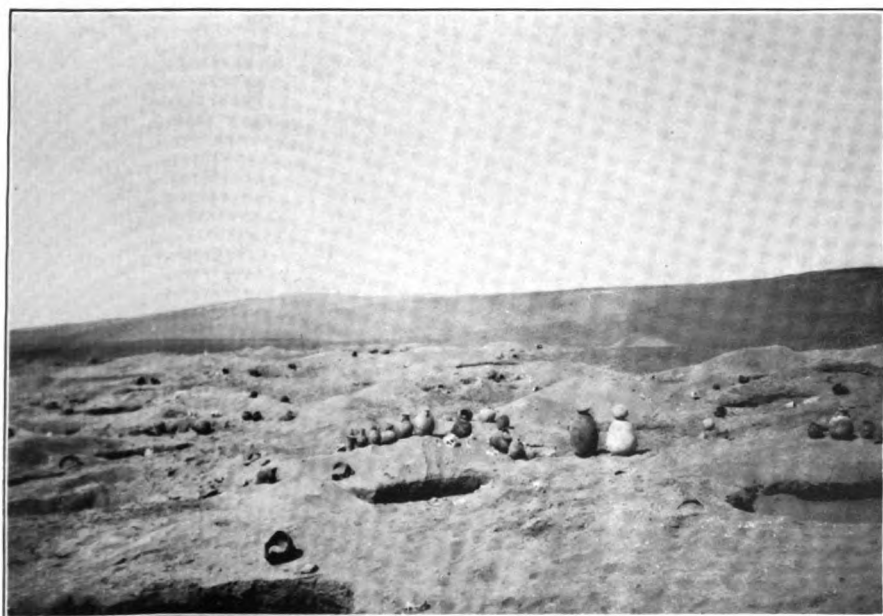


Fig. 2. Another part; the pottery is that of less salable grades and therefore broken or abandoned by the diggers

CEMETERY, IN ALL PROBABILITY PRE-COLUMBIAN, AT KILOMETER 98 ON THE R.R. FROM ANCÓN TO HUACHO, DESPOILED BY PEONS. THE CONDITIONS SEEN ARE QUITE TYPICAL OF MANY SIMILAR SITES IN PERU



Fig. 1. The diggers and their spoil (mainly in the bags)

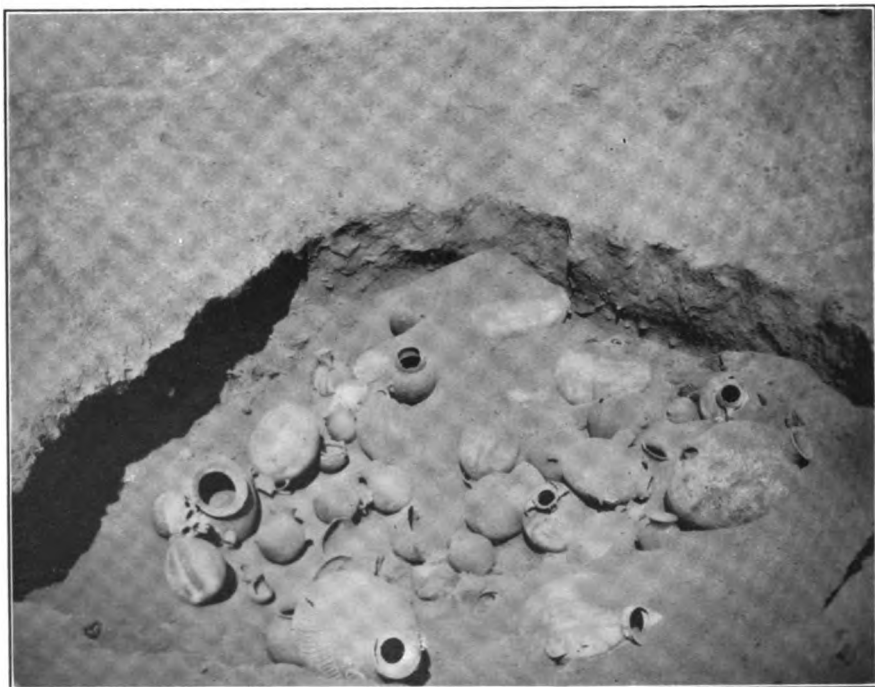


Fig. 2 Some of the abandoned pottery

SAME CEMETERY AS SHOWN ON PLATE 7, SHOWING A SUNDAY PARTY OF THE VANDALS AND SOME OF THEIR WORK



proved to be a party of railroad laborers, who came out under the direction of their foreman, to engage in their usual Sunday recreation of digging for pottery. Upon our questions as to who permitted them to do such work, the foreman met us only with indignities<sup>1</sup>; but later on, from apprehension, he became more civil and eventually, in the afternoon, finding that after he had loaded his men and his spoil some room was left on the car, he transported us, at a break-neck rate, to one of the wooden shacks built by the railroad for the accommodation of the laborers. Here my companion was taken ill; however, we spent another night on the sands and the next morning were taken back to Huaral.

The skeletal material recovered at "Kilometer 98" proved to be in all important respects like that from Ancón. An interesting specimen, the first of the kind met with by the writer along the coast, was one skull with the Aymara type of deformation. A large majority of the remaining crania presented a more or less marked fronto-occipital flattening. The few that were not deformed or were deformed to only a small degree, showed the ordinary brachycephalic type of the coast people. In regard to pathology about the same conditions prevailed as at Ancón.

*The Valley of Huacho.*—This extensive well-watered valley or rather low plain, was doubtless quite as thickly peopled before and early after the arrival of the white man as it is at this day. The proofs of this are seen in the numerous ruins, mounds or *huacas*, and old cemeteries. The ruins, of the adobe-block type, are found generally on the deserts outside of the cultivable grounds. The more important ones are located at the Pampa Industria, along the north-western border of the valley in the direction of Begeta, and in the neighborhood of the hacienda of Vilcahuaura. Huacas, which as a rule enclose adobe structures, are especially in evidence in the vicinity and to the east of Huaura. The cemeteries finally are located in numerous places along the edge of the sandy deserts surrounding the valley, especially to the southward, and some are of considerable extent.

The burial grounds examined were, one just south of the railroad line at Km. 140; one just to the east of the last curve of the railroad line before it enters Huacho; three or four extensive ones to the southeast of the valley in the direction of Agua Dulce and San

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<sup>1</sup>It is only just to the railroad authorities to state that when they found what happened, they promptly stopped the wanton destruction.

Lorenzo; one large and one small one near Huaura; three moderate-sized ones near Mazo and between this and Begeta; two at Pampa Industria; two at Vilcahuaura; and two burial caves at Quintay, north of Sayan.

Some of these cemeteries, especially that at Km. 140, are in all probability post-Columbian. The mummified bodies there are in a relatively fresh condition, preserving considerable odor of mummified and even decomposing flesh. Also the dead were buried here in the extended position as at the present time.

All of these cemeteries have been, of course, despoiled by the peon, the bones being left scattered over the ground. Due to damage during excavation and to disintegration of the longer exposed specimens by the elements, a large proportion of the skeletal remains, particularly on the sandy slopes to the southeast of Huacho, were already in poor condition. It was possible, nevertheless, to examine, with the cooperation of Dr. Tello, about 600 crania and a large quantity of other bones with the following results:

It was evident that the valley was peopled at all times by natives of good physique and of very fair, though not strictly tall, stature. The natives of the present day in this region, though largely of mixed blood, are still perceptibly more robust and look healthier than similarly mixed natives along other parts of the coast. The explanation of these facts is probably that the fertile valley has always afforded ample and good nourishment to the people; it was seemingly not as badly infected with malaria as other valleys along the coast; and the natives have never been reduced to peonage on a large scale. Many to this day possess a piece of rich land of their own and are practically independent.

Besides being sturdy the people of this valley were also remarkably free from diseases such as would leave their marks upon the bones. "Mushroom" femora were about as frequent as at Ancón, but symmetric osteoporosis of the skull was less common, nor were any extreme forms of it encountered, and other bone diseases as well as injuries were rare.

Anthropologically, the large majority of the Huacho Valley people of all times belonged to the coast brachycephals; two or three of the cemeteries, however, showed a very noticeable admixture of the more oblong skulls of the mountain type.

Most of the crania presented a more or less pronounced fronto-occipital flattening, but some percentage of little deformed or unde-

formed skulls, showing clearly the cranial type of the people, were encountered in every cemetery. An interesting fact is that there were found dispersed in the valley seven skulls, mostly of women, with a typical Aymara deformation. Whether these were slaves or individuals introduced in other manner among the Huacho people, and whether pre-Columbian or post-Columbian, could not be determined. None the less the occurrence shows that the Huacho Valley people came into contact with individuals of the Aymara culture.

Several specimens of special or collateral interest were found in this valley. One was a clearly syphilitic skull, and four evidently tuberculous bones. The period, however, to which these bones belonged could not be ascertained and it is quite possible that they were fairly recent. The rarity of fractures was very remarkable. Some of the skulls showed injuries by stones or clubs, but there were no trephinations. And there existed, doubtless due to strong development of the occipital tendons and muscles, an unusually large percentage of impressions (physiological) in the occipital at the inion.

So far as cultural objects are concerned, the pottery of the Huacho Valley, outside of some specialties, seems well to represent the more ordinary pottery common to the coast. There are, however, cemeteries which yield a better class of earthenware than others, and a few forms were seen which may be peculiar to this region. Besides pottery the people also made oblong moderate-sized palm baskets, which were occasionally buried with the dead, filled with utensils and materials for sewing and weaving. There were evidently few, if any, high class fabrics; but the ordinary weaving presented some local peculiarities, one of which was the frequency of network stuffs.

The caves at Quintay, distant about 50 kilometers from the coast and already well in the mountains, showed still a predominance of skulls with the fronto-occipital deformation, but about one-fourth of the crania presented undeformed oblong forms, such as those met with in the Huarochirí highland district farther south.

According to information obtained from various sources, considerable quantities of skeletal material lay exposed in the vicinity of Supe, about 32 kilometers in a straight line north of Huacho, and especially on the grounds of the hacienda Paramonga, in the neighborhood of Supe, but these regions could not be visited on this occasion.

## SOUTH OF LIMA

*Chorillos*.—Twelve kilometers south of Lima, on the coast, lies the watering place and town of Chorillos. Following the road which leads from this town eastward and then southward, toward Lurin, the traveler passes rather extensive adobe ruins, and at least two burial grounds. Curiously enough, though so near to Lima, these ruins and cemeteries have not as yet been properly explored. Uhle, on his archeological map of the Lima Valley (4to, Lima, 1907), marks them as belonging to the "last civilization of the valley before the Incas," but they are probably more recent. They show excellent construction from huge blocks of adobe, formed doubtless in situ, in frames. The burial grounds were examined by the writer in 1910, and were seen again on this occasion. At the former date a quantity of skulls and bones lay over the surface; these have since then almost entirely disappeared. The crania showed a prevalence of the antero-posterior deformation, and were evidently of the ordinary coast type, though occasionally an oblong skull was present. The bones indicated people of moderate stature and moderate muscular development.

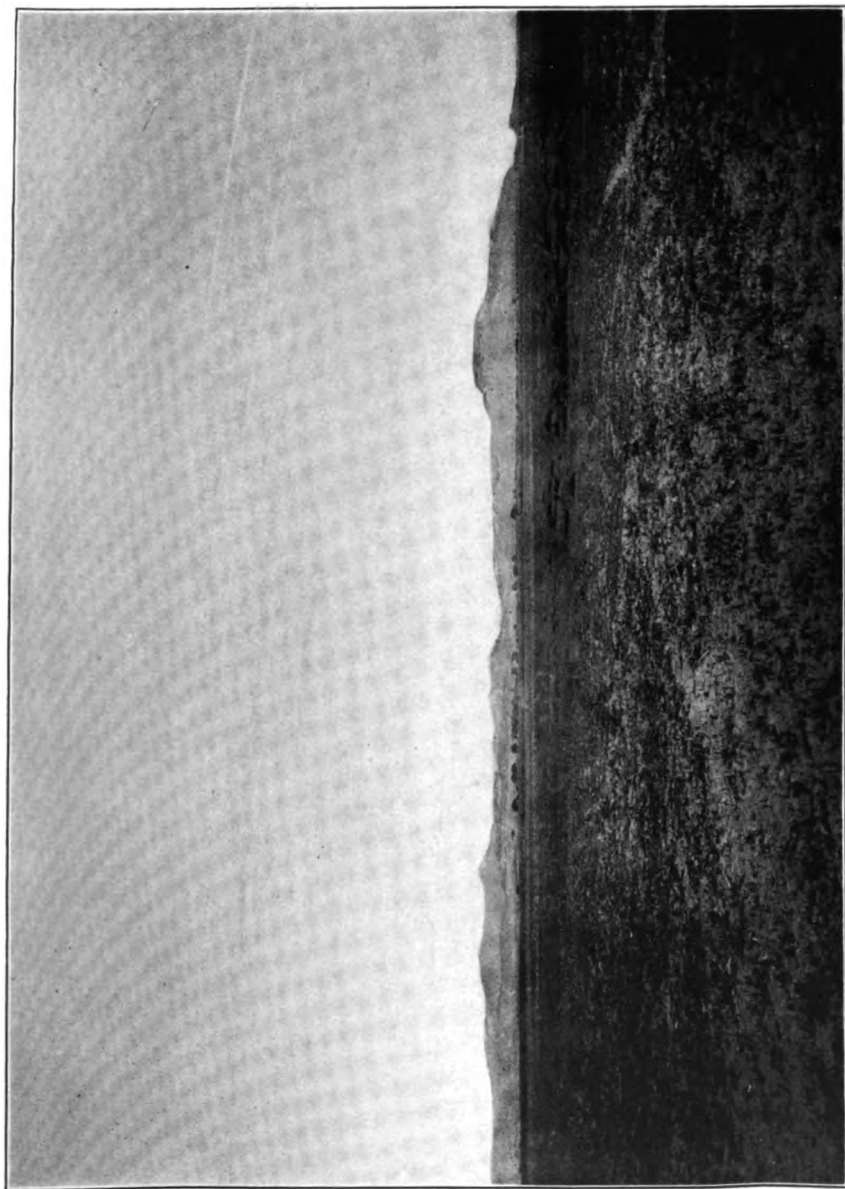
A considerable number of burials probably still exist in this neighborhood and they, as well as the ruins, deserve attention before it is too late.

*Pachacamac*.—About 18 kilometers southeast of Chorillos, within a few hundred feet from the sea and just north of the Rio de Lurin, on and about a number of moderate elevations, lie the great ruins of Pachacamac (pls. 9, 10) well known from Uhle's description.<sup>1</sup> The writer has referred to this old city, to which he made two brief visits in 1910, in another publication.<sup>2</sup> Although the present owner of the land on which the important ruins stand forbids the peons to excavate for themselves and is opposed to wanton destruction of the remains, still they are in a perceptibly worse state than three years ago.

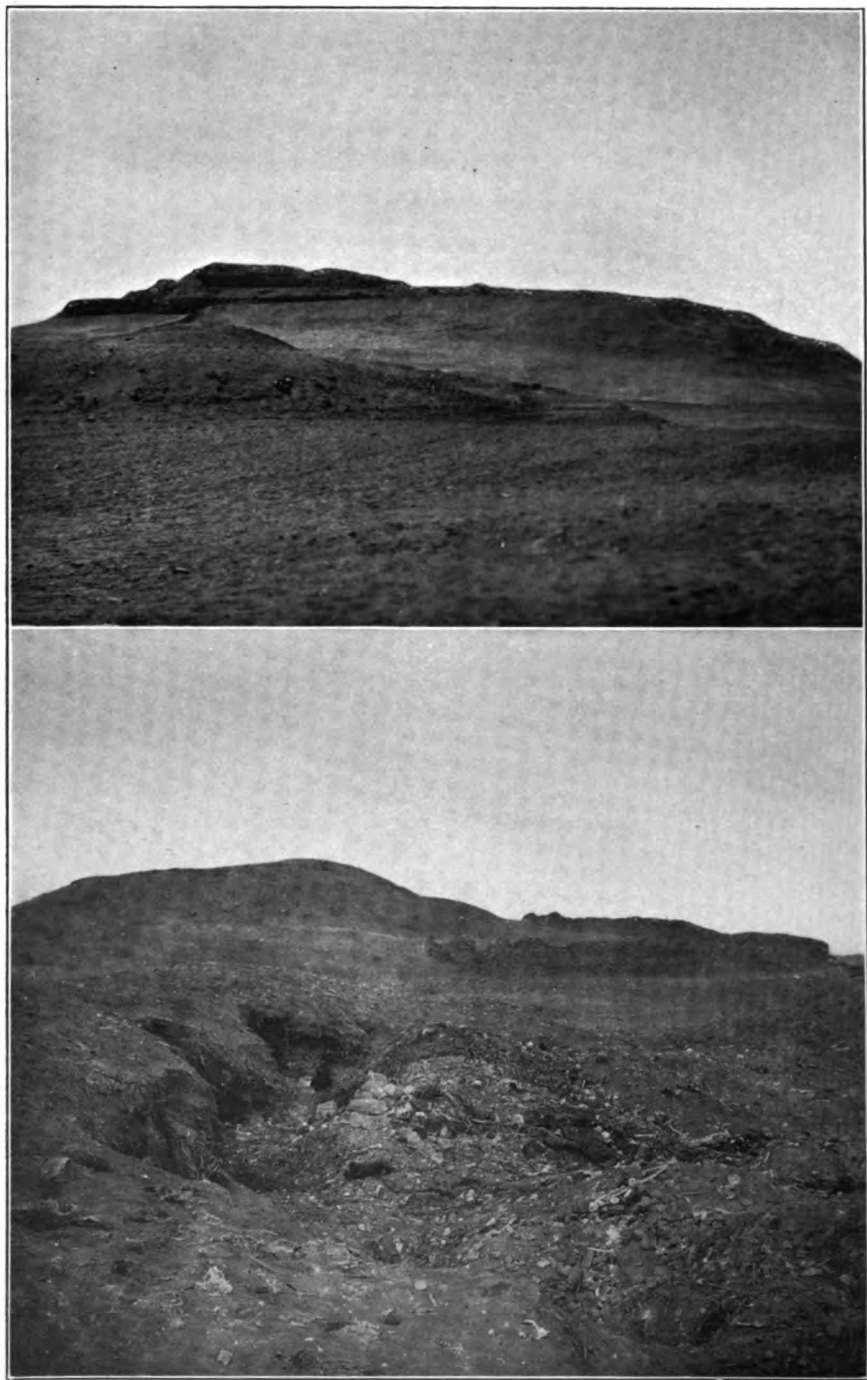
The abundant skeletal material found here by the writer in 1910, and from which 2,200 skulls with several thousand other bones were at that time secured for the U. S. National Museum, has in a large measure disappeared, mainly through the influence of the elements. New excavations, however, have been carried on for a person of high standing in Lima, and it was possible to examine

<sup>1</sup> Uhle, M.: *Pachacamac*. University of Pennsylvania Publications, fol., Philadelphia, 1903.

<sup>2</sup> Hrdlička, A.: *Some Results of Anthropological Exploration in Peru*. Smithsonian Misc. Coll., Vol. 56, No. 16 (Publication 2005), Washington, 1911.



PACHACAMAC FROM THE NORTHWEST. THE WHOLE RANGE OF LOW ELEVATIONS IN THE FOREGROUND IS ONE VAST STRETCH OF RUINS AND CEMETERIES. THE HILL OF THE "TEMPLE OF THE SUN" IS SEEN ON THE RIGHT



THE UPPER VIEW SHOWS THE HILL OF THE TEMPLE OF THE SUN AT PACHACAMAC, THE LOWER  
A RECENTLY TAPPED GROUND AT PACHACAMAC, FULL OF BURIALS

the skeletal material left from these (pl. 10, fig. 2). They have not changed the conclusions reached during the former visit, which, for easier reference, are with slight modifications here repeated.

The people of Pachacamac as well as those who did not live but were buried there, were of moderate stature and physical development, with shorter and weaker individuals rather frequent.

The crania belong largely to the brachycephalic coast type. A fair percentage is fortunately free from deformation and shows the type clearly.

With the more rounded skulls were mingled in some of the burial sites a smaller or higher percentage of more oblong skulls, occasionally attaining pure dolichocephaly. These skulls, it is now seen, are of a very similar type to those found in the mountain district to the east (the district of Huarochirí), and doubtless represent visitors, invaders, or an intrusion of these people. The majority of these narrower skulls were without any deformation, while a few showed some occipital compression probably of intentional origin. It was seen in the former part of this report that the oblong skulls from the mountains are generally free from deformation.

The majority of the Pachacamac skulls of the more round-headed variety and some of the narrower specimens, present a fronto-occipital artificial compression which, however, is seldom excessive. In some instances the frontal flattening is scarcely detectable, and there are cases in which, though they probably belong to the same class as the preceding, only an occipital flattening can be discerned. The pressure on the frontal must in these instances have been very weak. Deformed crania were particularly frequent in the large burial ground in front, that is just to the north, of the old temple of Pachacamac.

No specimen was met with at the former nor at the present visit to Pachacamac, which would show the "Aymara" type of deformation. This indicates that the highland people where such deformation was in vogue neither visited nor invaded the town or its temples.

A number of submicrocephalic and even microcephalic, but otherwise normal, adult crania were found in the vast cemeteries of this locality. They have nothing in common with the small skulls of idiots, being normal in every respect except size. They doubtless belonged, as shown by occasional small bones of the rest of the skeleton, to diminutive individuals. They range in capacity from 1,050 to 910 c.c.

The long and other bones from Pachacamac afford many features of interest, especially to pathology. Fractures, as elsewhere along the coast, were very rare. Symmetric osteoporosis of the skull and the "mushroom-head" femur, were fairly frequent, about as at Ancón. One plain case of trephining was found, one was discovered among the specimens collected on the first visit to these ruins, and three or four other specimens in the total collection show partly cicatrized lesions which may have been due to such an operation.

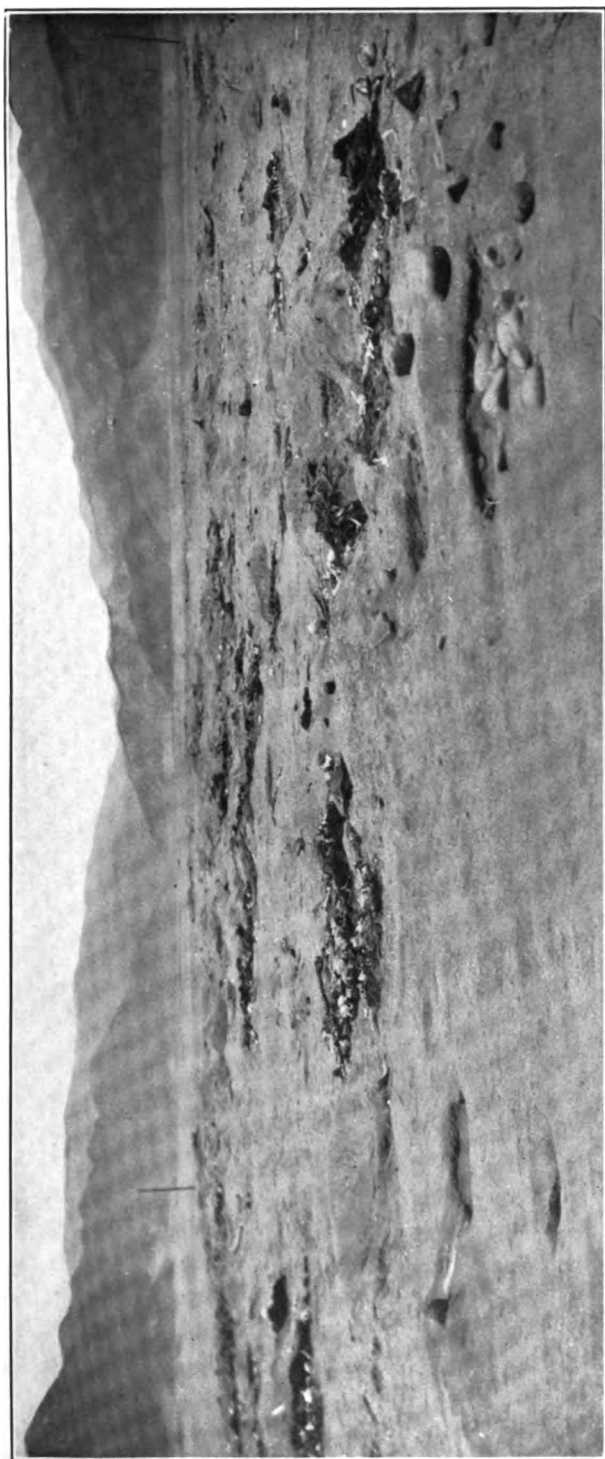
The Pachacamac burial grounds are still far from exhausted (pl. 10, fig. 2).

*Chilca.*—From Pachacamac, the main road south leads to the cultivated valley of Lurin and then follows the coast deserts to the large but, due to aridity of the region, now half-abandoned town of Chilca, 70 km. south-southeast of Lima. The visit to this place was due to information obtained from Sr. José Bravo, Chief of the Bureau of the Engineers of Mines of Peru, and was facilitated by kind aid from Sr. Bravo and Engineer C. W. Sutton.

Upon arrival at Chilca, it was found that one large and one small burial ground with a number of shell and refuse heaps existed to the north of the place, and that ruins with numerous burials were located on and about a hill three miles to the northwestward.

The main cemetery, which commences a short distance beyond the outskirts of the town, was found to have been in part recently excavated, for another a high dignitary of Lima; but the larger part of it is fortunately still intact (pl. 11). This burial ground proved on examination to be uncommonly interesting, for it was found to represent in a large measure a wedge-like intrusion among the coast population of the oblong-headed mountain people. The ground so far as dug over was strewn with bones and fabrics. The majority of the bones and skulls showed well-developed people of the type met with in the not far distant district of Huarochiri. Besides these there existed a moderate admixture of the more round-headed coast elements. As in the mountains, the oblong skulls were generally free from deformation, while those of the coast type showed mostly the intentional antero-posterior flattening, though not in a high degree. Two or possibly three cases of trephining were discovered in this burial ground, and there were a number of interesting pathological specimens, though on the whole the people have evidently been very healthy. There was no well-defined case of "mushroom-head" femur, and symmetric osteoporosis of the





THE CEMETERY AT CHILCA.



skull was rare—both features in which the population represented in the cemetery concurred more with the mountain tribes than with those of the coast.

The age of this cemetery could not be determined. The bodies showed many remains of the soft parts, which were not entirely dry. Also there was still considerable odor to some of the remains. The burials, however, were all in the contracted position, the fabrics were strictly of native material, design and manufacture, and no objects indicating contact with whites were encountered.

The burials farther to the north lay in the path of a shallow stream in which there is seldom any water; nevertheless we were informed that after a late freshet a number of the skulls and bones that lay on the ground had been washed away or covered. The skulls that remained, though mostly imperfect, showed the ordinary coast type of people. On and beyond the northern bank of the wash are various refuse heaps.

The ruins on the hill three miles to the northwest of Chilca are evidently the remains of a settlement, and possibly a fortification, of the people who cultivated the lowlands among the dunes which surround the hill from the southwest to the southeast. They buried principally in and at the foot of the slopes of the hill, and in the dunes. The skeletal remains resemble those of Pachacamac in every respect, including the admixture with the more oblong-headed type. Considerable fighting must have taken place about this hill, judging from the number of skulls showing wounds. Of 11 skulls found at the foot of the slope to the southeast, nine presented traumatic lesions which must have been mortal. The excavations in these localities were not recent and the exposed skeletal material was in general in a poor state of preservation.

No other ruins or cemeteries were heard of in the near neighborhood of Chilca, but important archeological remains are reported to exist to the southeast, on the Rio Mala, in the vicinity of Calango. These, as well as other ruins on that river and on the one a few miles farther south, were indicated on his map by Raimondi (see pl. 12). Still farther to the southward, about Cañete, other ruins exist, including the "Incahuasi" described by Larrabure<sup>1</sup>; and these are followed, farther southward, by the ruins and *huacas* of the region of Chíncha and Tambo de Mora, beyond which one enters the region of Ica and Nasca.

<sup>1</sup> Larrabure y Unanue, E.: *Incahuasi*. 8vo, Lima, 1912, pp. 1-16.

#### IV. EXPLORATIONS IN THE LOMAS AND RIO ACARÍ REGIONS

*Lomas.*—The rather insignificant port of Lomas lies about 280 miles southeast of Lima, and between 80 and 90 miles south-southwest of Nasca. It is formed by a small rocky barren peninsula, on which nestles the little sombre town of Lomas. The peninsula as well as the surrounding country is desert, but a sandy depression just to the north and northeast contains some moisture which gives rise to a sparse growth of vegetation; in the midst of this depression is a well which supplies a poor quality of water, used mainly for animals, while a better class of water must be brought from springs nearly three leagues to the north.

The sandy wastes just to the north of the road between the peninsula and the above-mentioned well, contain a number of old cemeteries. These as usual have been to a large degree dug over and despoiled by the peons. Judging from their extent, they represent a prolonged occupation of the spot by a fairly numerous people, reaching probably to post-Columbian times. Ruins, with the exception of a few remnants of walls on the northern border of the peninsula, are wanting. The region was in all probability peopled by fishermen, who for the most part built easily perishable habitations.

At Lomas the writer was fortunate enough to find an excellent friend in the wealthiest and most cultured man of these regions, a Piemontese, Sr. Enrique Fracchia, and whatever success attended the explorations between here and Ica is largely due to the generous assistance given by this gentleman.

The skeletal material exposed in the cemeteries about Lomas represented the remains of between 400 and 500 bodies. Much however is doubtless still left in the ground.

The Lomas cemeteries date plainly from different periods and do not represent exactly the same people. One of the small burial grounds is probably post-Columbian, though no articles of white man's manufacture lay exposed. In this cemetery the bodies were not only in fresher condition but the burials were extended, while in all the other cases the body was interred in the usual contracted position. An interesting ethnological detail is that all the bodies in this region, including even those in the most recent burials, were sewn and bound into bundles, and the clothing with other fabrics was more abundant than in any of the more northern cemeteries that were examined. These fabrics were predominantly of wool,











from the llama, but there were also those made of cotton. Besides the fabrics, there is occasionally discovered in these graves a palm fiber basket in character much like those of the Huacho Valley, filled with thread balls and various feminine utensils. Pottery, judging both from the reports and from the great scarcity of potsherds, is met with much less frequently than in the cemeteries of the Nasca Valley, but the varieties are on the whole similar. A specialty of these burial grounds, though later found over the whole Nasca region, was the frequency of the *huarakas* or slings, and of small round stones which were thrown from these. One or two of these slings were apparently buried with every grown male, while smaller ones were found with the male children. Some of the slings were beautiful examples of workmanship, and it was interesting to note that the design and colors on the strings near the central part generally imitated a serpent.

Physically, most of the people buried in the Lomas cemeteries belonged to the coast type of moderate brachycephals. Besides this predominant strain, there were varying proportions, according to cemeteries, of oblong-headed individuals, but the percentage was never very high. None of the people were very robust, comparing in this respect most closely with the inhabitants of Pachacamac. Also, the stature was very seldom above medium.

The usual coast fronto-occipital deformation was practiced extensively. But there were no extreme cases, and in numerous instances the frontal flattening was but little marked. Evidently none of the Peruvian coast people used planks to produce the deformation, such as have been in vogue, for instance, in the Columbia River valley. More probably they employed a pressure by a pad or a double pad over the forehead, the bandage fastening the head to something which simultaneously, by counter pressure, flattened the occiput. It was frequently seen that the more oblong-headed individuals have also suffered from the antero-posterior deformation, showing that they were already inherent units of these tribes and followed the same culture. Only a small proportion of both the brachycephalic and the more oblong crania in the older cemeteries of Lomas were undeformed. No example of "Aymara" deformation was discovered.

From the pathological standpoint, the symmetric osteoporosis of the skull was found to have been frequent but generally rather mild. Not even one fracture of any of the long bones nor dislocation was noted; but wounds of the head by sling projectiles or clubs

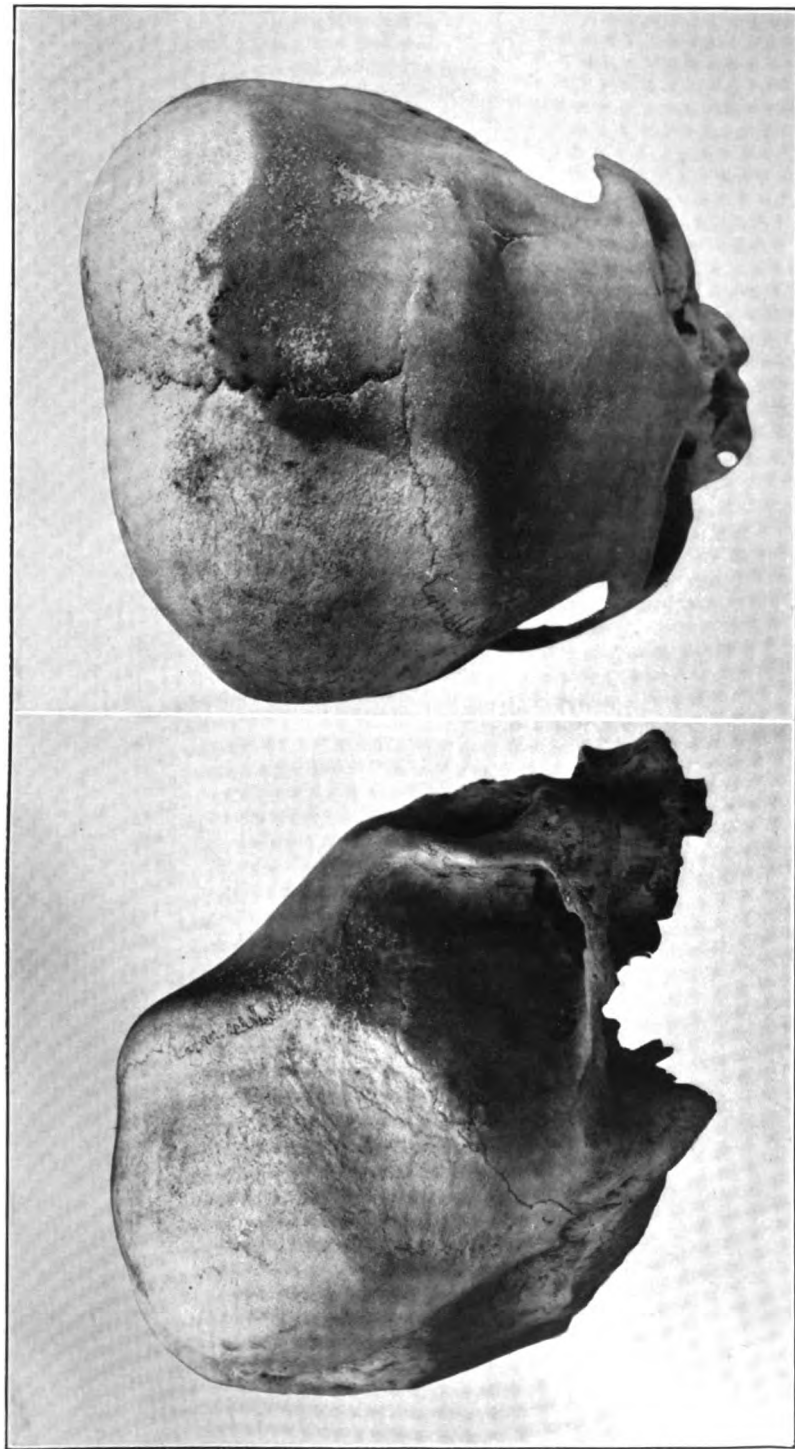
were very common. In one of the small cemeteries, every subject, men, women, and children, was thus killed; and in the majority of cases the wounds were in the posterior half of the skull, indicating that the people were probably slain while running away from those who attacked them.

Trephining was very rare, if practiced at all. Two specimens were recovered which show a partly healed lesion that may have been a trephining, but the diagnosis is not certain.

Not one really pronounced "mushroom-head" femur was found, and even moderate grades of the disease were quite rare, which seems to justify the conclusion that this peculiar disease was more prevalent among the coast people farther north. Signs of more ordinary arthritis, on the other hand, especially on the vertebræ, were not infrequent. Dental caries, curiously, was rather common in this locality.

*Chaviña*.—About 20 miles, by the road, southeast of Lomas is found the mouth of a fair-sized river, known on maps as the Rio de Lomas, but locally called Rio Acarí. The cultivated lowlands on both sides of the river at this place constitute the hacienda Chaviña (fig. 1). The dwelling of the overseers is situated at the edge of the high ground which bounds these lowlands to the northwest, and a short distance to the east of this building, among low sandy hillocks, exists an extensive and highly interesting old cemetery. Three other burial grounds, or rather one cemetery in three parts, are situated about two miles to the west of the dwelling on the lower sandy ground near the sea and not far from a hill fortified by the ancients, the locality being known as Conventillo; while several small to fair-sized burial grounds are found in the sandy slopes on the south side of the river, opposite the headquarters of the hacienda.

The scattered cemetery east of the house showed exposed the skeletal remains of about 200 individuals. So far as it was possible to judge, the brachycephalic element was predominant, but there were also longer skulls. A highly interesting feature was the prevalence of extreme forms of fronto-occipital compression, produced evidently by tying the head very firmly to a plank or cradle-board (pl. 13). This was the first cemetery in Peru where such pronounced deformations were seen, but another one was heard of to the south of the river, one was found later on in the valley of the Rio Grande de Nasca, and still another was seen about 60 miles to the north of the valley at the hacienda Ocucaje, near



A SKULL WITH AN EXCESSIVE AND PECULIAR FRONTO-OCCIPITAL OR "FLAT-HEAD" DEFORMATION, FROM CHAVINA, ON THE RIO DE ACARI, (S. "R-DE LOMAS") PERU

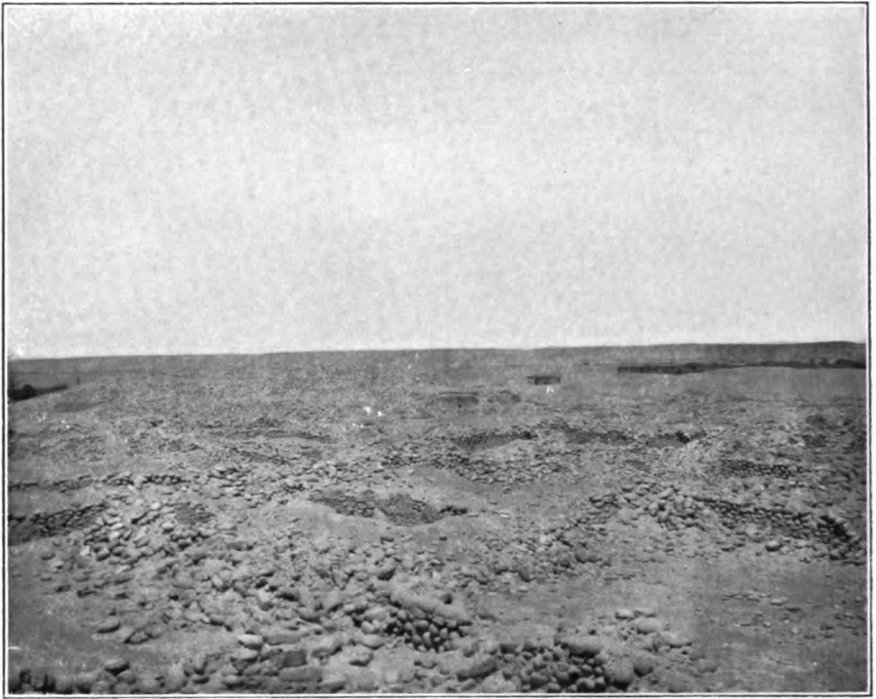


Fig. 1. Remains of walls, made of waterworn stones, on the plateau



Fig. 2. Part of the plateau and the slope towards the river

TWO VIEWS AMONG THE ANCIENT RUINS KNOWN NOW AS TAMBO VIEJO, NEAR ACARI

Ica. They doubtless represent a special clan or tribe of the coast people.

In contrast to the cemeteries of Lomas and also to those at Conventillo, the burials in this locality were poor in fabrics, including slings, but there were present wooden clubs made of the heavy huarango (a variety of mesquite). Another interesting condition was that some of the burials at least were made in stone-lined pits. The bodies were buried in the contracted position.

Pathologically, the bones of this cemetery showed a prevalence of arthritis; but there were no well-developed "mushroom" femora, and only traces of osteoporosis. Otherwise the conditions agreed with those of the rest of the coast people in this vicinity.

The cemeteries of Conventillo have yielded glass beads, copper pins made in the European style and some other objects indicating contact with the whites, and must therefore be classed as post-Columbian; but they date probably from the early part of that period. The burials, as at Lomas, were rich in fabrics and especially in slings, and the fabrics in general were identical in material, colors and designs with those of Lomas. The skeletal remains also, physically as well as pathologically, presented identically the same conditions as those from the Lomas burial grounds. There can be no doubt but that these remains belong to the same tribe of people as do the majority, at least, of those of Lomas, and their date is also a valuable index for the antiquity of those from the more northern locality.

*The Acarí Valley.*—The narrow valley of the Rio Acarí, from Chaviña to Otapara (a distance of about 30 miles), is dotted and in some places overspread with the relics of the aboriginal population, both ruins and cemeteries (fig. 1). Of these remains, those on the south side of the river could not be examined closely on account of the impassable condition of the stream at this time.

Along the north side of the river ruins and cemeteries are found in the vicinity of all sites where cultivation of the lowlands was possible. The ruins show low walls or foundations, made of water-worn stones, without any cement. Evidently the remainder of the dwellings was of more perishable nature and has completely disappeared. The enclosed spaces are rectangular and generally of moderate dimensions.

Burial grounds, merely tapped or excavated only in part, exist near all the ruins. The skeletal remains exposed are fairly abundant, but often in poor condition. Moderate fronto-occipital

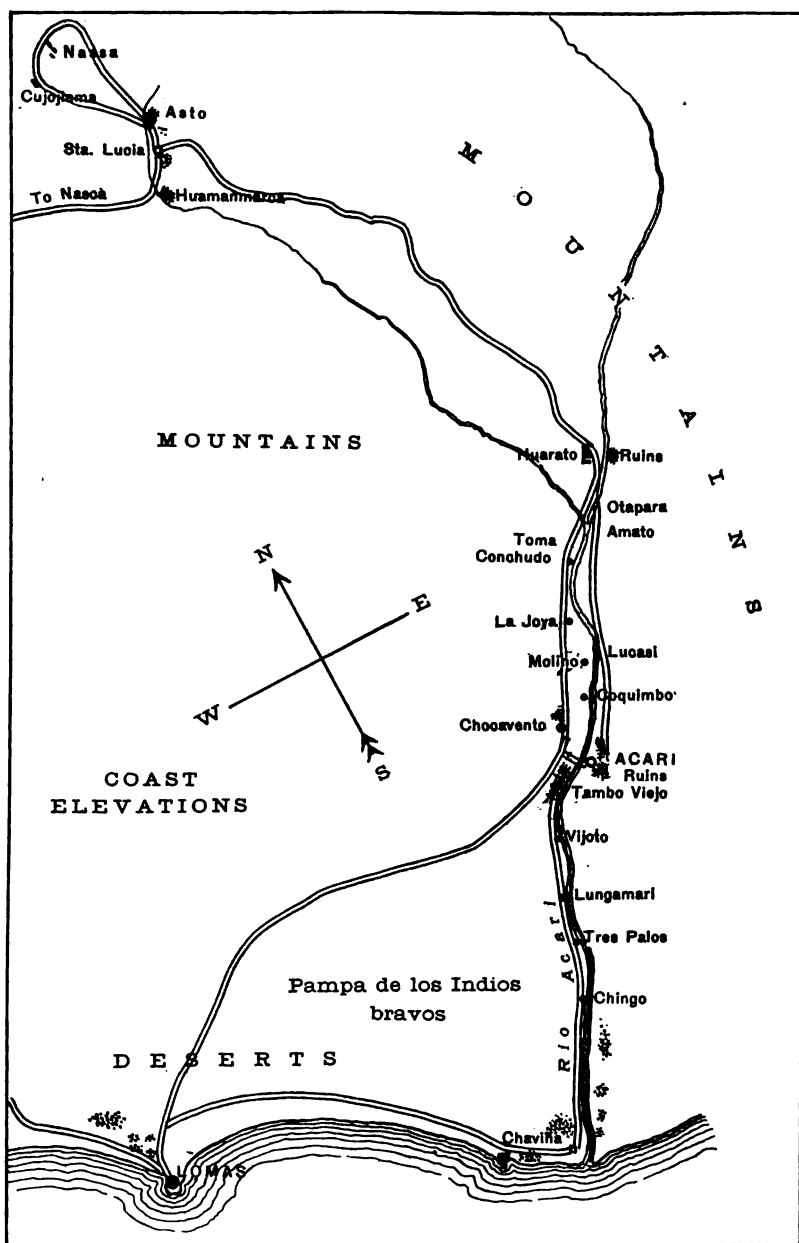


FIG. 1.—Sketch map of the Lomas, Rio Acari, Sta. Lucia Region.  
(Cross lines indicate ruins; groups of dots are cemeteries.)

deformation of the skulls is general. The coast type of people predominates; in some of the cemeteries however there is a marked admixture with the more long-headed and less deformed element. and in one moderate-sized burial ground the latter type existed almost to the exclusion of the former. The culture of these different groups was, however, very similar. The architecture is the same; there are everywhere traces of cylindrical or oval stone-lined burial pits; and the fabrics, as well as pottery (neither abundant), are, as far as could be learned, also alike. It therefore seems safe to conclude that the valley was settled by people of only one cultural group, which however included sub-tribes or clans physically more or less distinct and which perhaps did not occupy all the sites that now bear archeological remains contemporaneously.

The skeletal remains show that the people, while not very robust, were remarkably free from such diseases as affect the bones. The very few fractures found indicate a lack of surgical knowledge in treatment. As on the coast, numerous skulls showed lesions produced by stone projectiles or clubs. No instance of trepanation was discovered. Also there was no case of the "Aymara" head deformation. All the burials were in the contracted position and the body, covered with one or two fabrics, was tied up in a pack. In rare instances there were large, more elaborate, cotton-padded mummies, surrounded by some fabrics, resembling closely those of the Nasca Valley. Pottery, not very common, approximates the Nasca type.

*Tambo Viejo*.—About 16 miles from Chaviña and almost opposite the present town of Acari, the flats to the north of the river are covered with extensive and interesting ruins known as Tambo Viejo (pl. 14). The ruins consist of many foundation walls, walls of houses, and two *huacas*. The dwellings were, as a rule, quadrilateral, often square, with frequently a stone-lined pit in the center of the floor. In general, they were of moderate size. The upper parts, above the stone foundation, were doubtless of reeds or other perishable material of which no trace now exists. The stone walls were made of moderate-sized cobblestones, laid with mud mortar, and notwithstanding the fact that the material does not yield itself readily to high-class results, the constructions show very good workmanship. In a few instances the low stone wall was heightened by adding small adobes. The base and southern slope of the *huacas* facing the river were carefully paved with larger cobblestones, while their interior disclosed adobe constructions. To the north of the

*huaca* adjoining the river is a large square surrounded by houses and the other mound. In a northeasterly direction, across the square, is an elevated compound of constructions which were apparently of some special importance. To the east of the ruins extend the burial grounds, which, on account of the difficulty of excavation (the ground being full of water-worn stones), have as yet hardly been touched by the peon. At a few spots where excavations have been made the skeletal remains show the usual coast type of population.

*Acari, and Eastern Part of the Valley.*—A short distance from Tambo Viejo is a primitive ferry which transports one across the raging river (in the rainy season), to Acari. This is a small town with mixed-blood population, situated on a moderate-sized flat made in previous times by the river, and extending close to a rocky hill, lying in the shadow of the high slopes behind. The lower part of this hill is covered with many remnants of ancient stone constructions. Just to the east of the hill, following the valley, in sandy nooks between smaller elevations, are found burials, which again show the usual characteristics of the coast people.<sup>1</sup>

A little over a mile northeast from Acari, to the north of the river, is the hacienda Chocavento, belonging to the brothers Orezzaoli. Here the writer stopped three days, exploring the neighboring territory.

Some burials of the coast type people were found just to the east of the dwellings of the peons belonging to the hacienda. Crossing the river once more and following the valley eastward for approximately four miles, a small burial ground was found on the low sandy slope, not far from the stream, opposite the little settlement of LaJoya; and about four miles farther east, near the abandoned hacienda of Amato, another burial ground was examined. A short distance northeast of Amato on the north side of the river is a small rocky hill, known as Otapara, with numerous remains of walls of ancient habitations; this will be described subsequently. Traces of irrigation were seen on the south side of the river, but no ruins with the exception of those near Acari.

On the north side of the river in this vicinity there are also no ruins of any account, but at two spots in proximity to the road some uncovered skeletal remains indicated burials. A regular

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<sup>1</sup> It is worthy of remark that the first native in this region who could be regarded as a full-blood Indian was seen at Acari; he was, however, only a visitor of the place, coming from the sierra.



cemetery was not found until near the above-mentioned hill of Otapara.

*Otapara* (pl. 15) was evidently in the past a place of some importance. Now it is uninhabited, with the exception of three huts of Quechua-speaking mixed-breeds, recently erected. The hill was found to be a rocky elevation less than 100 feet in height, but difficult to scale, and, on the land side full of ruins of stone walls. Some of these doubtless represent habitations, while others may have served more for defence. The workmanship was mediocre throughout. Many potsherds of common kitchenware lay about, and strewn over the hill, especially at the summit, were numerous bones of the llama. At the foot of the hill to the north several chambers were excavated by the peons, yielding a little pottery, a few copper implements and a number of burials. The skulls and bones showed a more or less brachycephalic population, of moderate stature, with frequent fronto-occipital head deformation, hence the type of the coast.

*Acari Valley as a Whole.*—On the whole, the skeletal remains seen in the Acari Valley, from Chaviña to Otapara, were found to represent predominantly the now well-known coast type of the Peruvian Indian, with more or less admixture of the more oblong heads, some intrusion of which occurs in so many other localities along the coast. All the principal characteristics of the skulls and bones of the people of this region are exactly like those from the Pachacamac and Chimú cemeteries in the north. The resemblances are so close, even in regard to the admixture with the more oblong-headed elements, that the three groups cannot be considered otherwise than as parts, and that contemporaneous parts, of the same people. Throughout the valley there were many evidences of warfare in the numerous wounds found on the skulls. In the majority of cases these wounds were made by rather small stones, doubtless sling shots; in others the skull was crushed by a club. As to diseases, no very advanced case of symmetric osteoporosis of the skull was discovered in these regions, nor any pronounced case of "mushroom-head" femur. The majority of the scarce pathological specimens seen consisted of arthritic changes, and rarely a variety of osteoperiostitis attacking some of the long bones, especially the tibia. The dead, as a rule, had been buried in the contracted position and bound in a bundle. Such a bundle or pack regularly showed some thin fabric about the loins of the body, a cotton or woolen shirt, or a blanket, and occasionally a *faja* (sash), a *telega* (woven bag), or a *huaraka* (sling). The bundle would be tied sometimes, in a wide-meshed network, with a rope

made of the wool of the llama—exactly similar to the rope used at this day by the more primitive mountaineers just to the east of this region. Such a pack would be buried in a pit three and a half to six feet deep, sometimes without, sometimes with, a piece of decorated pottery.

*Huarato*.—Three miles from Otapara, farther up the valley, is a locality known as Huarato, now occupied by a moderate-sized hacienda. From this place the roads divide, one leading farther up into the narrow valley, while another ascends a high mountain and leads to Sta. Lucia, Puquio and Andamarca.

In the past, the neighborhood of Huarato was evidently well peopled. On a low sandy elevation across the river are seen the ruins of a moderate-sized old town, with rectangular pebble-stone foundations, as at Tambo Viejo. This belongs doubtless to the valley and coast culture. On the north side of the river, however, and just beyond the hacienda—in fact including a part of the ground of the present buildings—is found a large and highly interesting earthwork rather than a ruin, unlike anything seen elsewhere in the valley (fig. 2). It consists of a low artificial ridge, not unlike a breastwork, made of earth and adobes and running for about 300 feet from west to east. From this run at right angles four or five similar though less distinct ridges, 200 feet down the slight slope in the direction of the river. Within the two enclosures formed by the more eastern ridges are seen the remnants of adobe foundations of the dwellings, and also low elevations the nature of which could only be determined by excavation.

One of the more western transverse ridges of these curious remains of antiquity contained a number of superficial burials which were dug out by the peons from the hacienda, and, most unexpectedly, the crania from these showed without exception a typical “Aymara” deformation. This was the first instance of such an occurrence met with on the coast—nor was anything like it seen in the further explorations to the west of the mountains.

Having secured with considerable difficulty the help of a man and a single heavy spade, the writer chose, more within the ruin, a spot which looked as if it might contain a burial and made excavation. We passed through a layer of sandy earth, then through one of earth and ash, through another layer of earth, and through an accumulation of chunks of adobe and numerous fair-sized cobblestones. Finally, at the depth of four feet, lay a bundle containing a skeleton. The body was buried in the contracted posture,

and was tied up in a single piece of ancient cotton cloth of natural color and poor quality. The bones were those of an adult male. Again the skull showed the "Aymara" deformation. No earthenware or other articles were buried with the body. A decorated moderate-sized jar of dark brown color was shown to us later at the

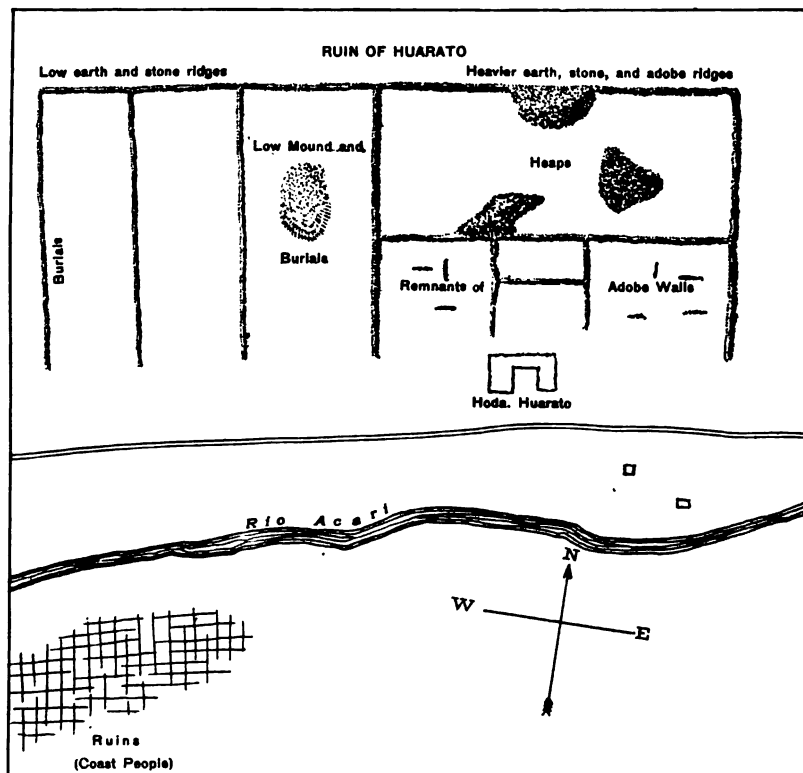


FIG. 2.—Sketch of Huarato, showing approximately the lay and ground-plan of the peculiar ruins of the people with the Aymara head deformation (to the north of the river).

hacienda and was said to have been dug out from another burial in these ruins.

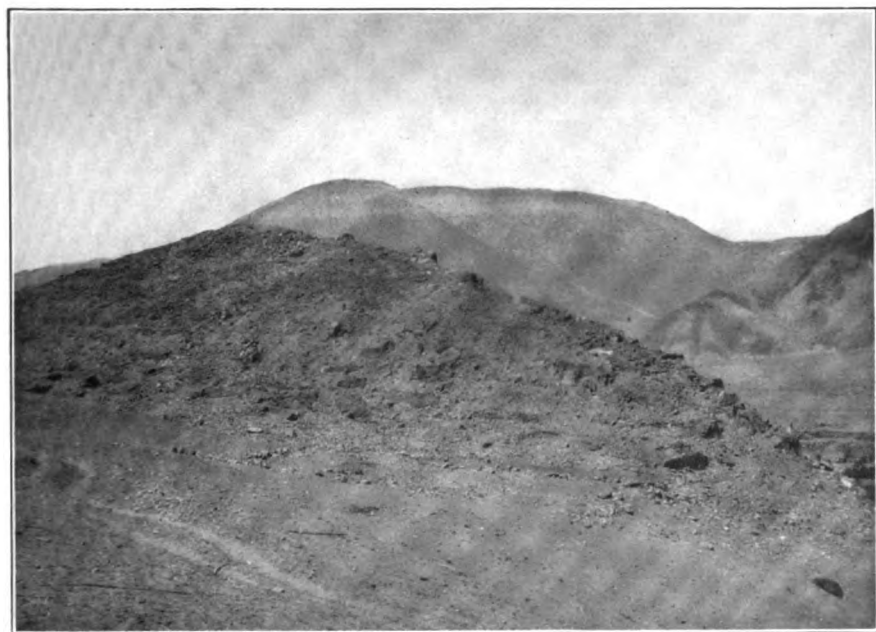
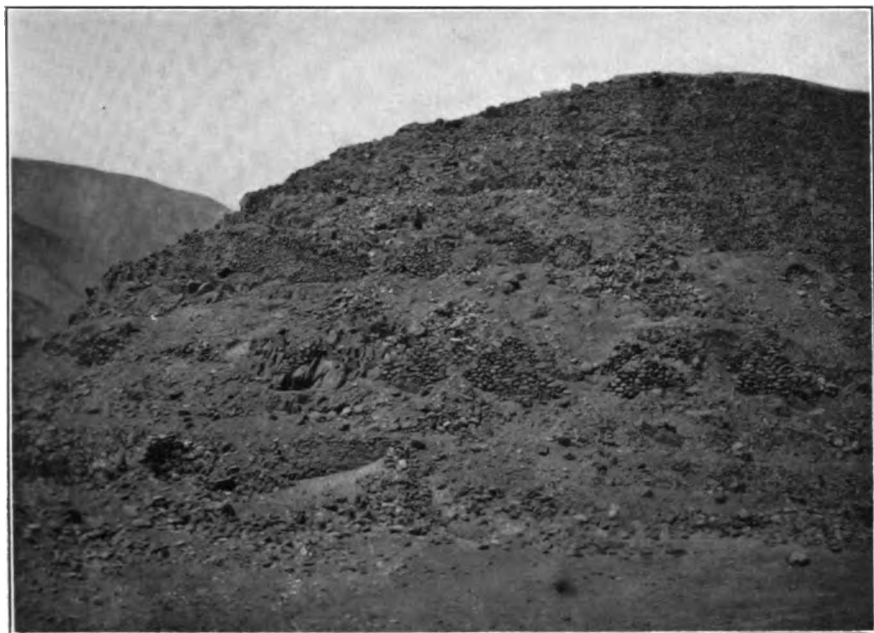
It is evident that these ancient remains of Huarato present a very interesting intrusion into the coast region of people from somewhere in the mountainous country farther to the east, and the burials at this place, hardly touched as yet, deserve a careful excavation.

## V. EXPLORATIONS IN THE MOUNTAINS TO THE NORTHEAST OF THE ACARÍ RIVER

*Santa Lucia*.—After a day's stop at Huarato, the writer set out once more for the sierra, which holds a key to many of the anthropological problems of Peru. The parts of the district of Lucanas now entered have never before been visited by a scientific explorer. They were reported to contain numerous ruins as well as burial caves, and as a further inducement the writer was informed that a three days journey from Huarato, in the old town of Andamarca,<sup>1</sup> there could be found many full-blooded Indians, speaking scarcely anything except Quechua and preserving their ancient dress as well as many old customs.

The writer, unfortunately, was to be guided and assisted by a merchant from Puquio. For the convenience of this merchant, the start from Huarato, on the 17 leagues (over 40 miles) journey to Sta. Lucia, was not made until five o'clock one afternoon. The main ascent of the mountain occupied over four hours. Long before that the sky became overcast, the darkness was almost impenetrable, and our animals stumbled on the perilous path. After we reached the top we were in addition overtaken by the usual cold drizzle of the rainy season in the hills, and this accompanied us the remainder of the journey. After midnight, the hitherto sandy upper country became more rocky and the darkness quite black. The animals could no more be guided, and we labored down and up, slipping and climbing, not knowing where we were or where the next step might land us, until three o'clock in the morning. That we this time escaped serious injury was a marvel and wholly due to the sagacity of the animals. When we emerged we were on the freer ground near Sta. Lucia. The miserable village itself was reached about three quarters of an hour later. Approaching, still in the rain, the hut where there were to be accommodations for us, we found first that it was very inadequate in size; second, that the yard was a pool of ill-smelling mud and water; and third, that the roof of the addition, more a shed than a part of a dwelling, which was to be our quarters, leaked so badly that there was no place inside where one could lie down or even crouch to sleep and escape the dropping water. It was raw and chilly. Two of the burros with loads had been lost in the darkness. But we were weary, and so the merchant took a corner of the floor, while the

<sup>1</sup> This is not to be confounded with the Andamarca farther north reported upon by Raimondi and Barrailler. Bol. Soc. Geog. Lima, Vol. 2, 1892, p. 121.



THE HILL OF OTAPARA, IN THE VALLEY OF THE RIO ACARI, COVERED WITH ANCIENT RUINS



Fig. 1. The fortified hill of Huamanmarca



Fig. 2. Despolled stone-lined burial pits at Huamanmarca, with decomposed bones to the right  
THE FORTIFIED HILL OF HUAMANMARCA, NEAR STA. LUCIA

writer rested on a primitive improvised narrow platform, a few sticks on four green forked poles, and the rest of the night was passed in wet oblivion.

At this place, with people too indolent to make even a ditch to carry the water away from their yards, with the baby of the family ill with bronchitis and the mother with tuberculosis, it was necessary to stay several days; and each day from four or five to 16 hours of cold drizzle. All this is mentioned merely to show some of the difficulties under which, at this season at least, the explorer labors in the Peruvian mountains, and some of the reasons why Andamarca was never reached by the party. The other reasons were, impossibility of obtaining native help and animals, and limits of personal endurance. The promises of the merchant proved to be just so much "palangana," an expressive Peruvian word, meaning the saying of a great deal that is never meant, or known.

Notwithstanding the untoward climatic conditions, the stay at Sta. Lucia was well utilized for examination of the region. The village doubtless lies on the site of an old native settlement. A number of large stone-lined burial pits, unfortunately almost wholly despoiled, exist in the slope of the hill opposite to the northeast. On the higher ground more to the north are stone ruins and the remains of a small row of partly subterranean, more or less oval burial chambers, plainly modifications of the burial houses of the more northern regions in the sierra. Farther to the north, on still higher ground, are other burial houses of the same nature and numerous remnants of low stone walls of habitations, as well as some beautifully preserved terraced fields or andenes; this locality is known as *Asto*. Across the valley of the stream that flows by Sta. Lucia on the west, there are other ruins and burial houses; and on the high plateaus to the north are ruins of dwellings, remnants of enclosures, and other evidences of ancient occupation. Finally, three miles southwest of Sta. Lucia down the valley, is a remarkable fortified rocky hill, with various burial houses, and with clear outlines of extensive slightly terraced fields about the base, known as *Huamanmarca* (pl. 16).

Most regrettably the more easily found burials in all the above places were thoroughly excavated many years ago and nothing was found left of the remains beyond small piles of decomposed bits of bone. However, in the burial houses between Sta. Lucia and Asto were seen several damaged skulls which indicated a type of people like those of the coast, with moderate fronto-occipital deformation.

After the ruins nearer to Sta. Lucia had been examined, an excursion was undertaken, with two of the mixed-blood natives, to the much higher and rougher regions about 15 miles north-northeast of the village,<sup>1</sup> where burial caves were reported.

The region now reached was found to consist of more or less parallel granite ridges or long narrow mesas, separated by canyons—in no case probably over 300 feet deep, but with slopes rather steep and full of boulders. A curious geological feature, not seen elsewhere in the writer's travels, was that in a large proportion of the greyish granite boulders there were nicely shaped rounded or oval cavities, in some instances amounting to good-sized caves, evidently blasted out by the winds. It was in two such cavities that, wet to the skin, cold, with soaked horse blankets beneath, wet poncho for a cover, and nothing more for supper than a box of sardines with a handful of parched corn, there was passed another night to be remembered.

In the morning it developed that my guide, besides being afraid through superstition, was not any too sure of the location of the burial caves, which by this time were reduced from several to "one or two," and we therefore set out to find some shepherds. In this, due to some native instinct of my companions, we were successful. We found an old woman with three daughters, of somewhat mixed blood, but speaking nothing but Quechua; had a royal breakfast of hot goat's milk with fresh parched corn; even found some tough grass for our animals; and then set out for the cave—only one now remaining. But it so happened that one of the young women, with a child, had an inflammation of the breast and in reward for the little help which it was possible to give her, her old mother volunteered not merely to locate exactly the cave we sought, but also to show us another one, unknown to anyone except herself, though at some distance.

We started for the first cave, while the old woman promised to meet us later on. Descending from the hut down one of the canyons through which was running a small stream, we saw on one of the slopes the remnants of crude stone walls; and about 15 minutes later, in a second canyon, we came to the burial cave. It was a good-sized rock shelter in the slope, and had been closed by a stone wall. Now it lay about two-thirds open, with its floor strewn with stones, skulls, and bones. Not far from 100 skulls and a large

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<sup>1</sup> These directions and distances must be taken as only approximately correct.



quantity of corresponding bones were found here. They belonged to healthy, strong and rather tall people, with evidently normally meso- to brachycephalic skulls, but which in every case presented more or less the "Aymara" deformation.

This cave is known as *Nassa*, which is said to be a Quechua word, but the signification of the term was not known to the writer's informers. The accumulation of human remains in the cave represented plainly a secondary burial. There were no traces of pottery, nor any metal objects, but shreds of fabrics were present, some of which showed handsome colors and weaving. For the first time also since the writer touched at Lomas, there was an absence of wounds of the skull.

Just as the exploration of the cave and the selection of specimens were finished, the old shepherdess was seen descending with her dogs from the opposite ridge among the bowlders. She was soon with us, and then led us up ridge and down canyon, over native trails and again where there were no roads, until we reached, still surrounded on all sides by bowlders, an elevated V-shaped nook on the slope not far from the top of one of the mesas, in one side of which was seen an oblong, black crevice, closed except for a small opening by stones. Through the opening, the writer could see a large, dark cavern, the floor of which was covered to about two-thirds of its extent with human skulls, pelves, spines with ribs and bones of the limbs.

That forenoon, fortunately, we for once had no rain and the light was quite bright, so that, removing the stones, it was possible to crawl in and examine the inside without a fire. Upon entering it was evident that, for the first time since the writer's work in Peru, he was in a burial cave which had not been visited or disturbed by anyone. The skulls and bones lay exactly as placed there by the Indians, not even showing any damage by rodents or carnivores. The hollow of the cave was filled with droppings—probably of the guanaco which still abounds in this region, and a large number of the bones and skulls were buried entirely or partly in this substance. About 40 skulls, however, and numerous other parts of the skeleton lay, as before stated, uncovered. As in the first cave so here all the crania, with one exception, showed a typical "Aymara" deformation. As to the undeformed specimen and several of those where the deformation was of slight degree, they showed not the small oblong type of skull which we thus far have associated with the term "Aymara," but more rounded and in instances quite large

crania, which could be more directly compared with the better developed type of the coast skull, or with the shorter, undeformed crania found mingled to some extent with the prevailing longer type in the sierra of Huarochiri.

Again as in the Nassa cave, the burials were plainly secondary, and it was evident that in many instances a body only partly decomposed had been forcibly disjointed to a greater or lesser extent, before being placed in its last resting place.

Although the sun was shining when the writer entered the cave, before he was through with the examination of the skeletal remains lying on the surface, thick mists began to envelop everything about, and were soon followed by the "aguacero" or cold drizzle. A large quantity of skeletal material still remained buried in the refuse with which the cave was filled, but it was necessary to hurry and only the more accessible parts could be examined. The total number of skulls inspected was more than 100, and according to the indications there were possibly as many more in the cave. Besides the skulls numerous other bones were looked over. Among this mass of material not a single pathological skull or bone was discovered. Also, there were neither pottery nor fabrics, but a number of various sized undecorated gourds lay on the floor, probably representing vessels that contained food and drink offerings.

The native name for this cave is *Cuxoxloma*, which again is said to be a Quechua term, but of unknown signification. It is not impossible, however, that these names are derived, in common with some others met with later on in these regions, from some other language.

While the cave was being examined, the old woman and also the writer's companion kept carefully at some distance away, for fear of the dead. The limit of daring was shown by the younger man in taking the selected specimens from before the opening of the cave, out of which the writer pushed them, and placing them with grass in bags.

No cultivable grounds and no ruins exist in the proximity of this cave or in the nearer neighborhood, and the remains must have been brought here from some distance. Exactly who these people were remains to be determined. The Aymara deformation may have been only an extension of that habit from the real Aymara people southeast of this region.

*Sta. Lucia to Nasca.*—Having done what was possible in the vicinity of Sta. Lucia and not being able to go farther inland, the

writer started for his original goal, the valley of Nasca. The journey by the route chosen occupied, not counting the stops, two and a half days, and showed a number of interesting conditions.

The first stop was made at the old fortress Huamanmarca. The fortifications were primitive but extensive and before the introduction of firearms must have been quite effective. In and about the fortifications, especially on a hill to the northwestward, were found quantities of quartzite chips and rejects, indicating a considerable stone industry. A somewhat similar condition had been seen at and above Asto. No finished implements were discovered, but, according to the natives, arrow points, larger worked blades, star-shaped club heads and other articles of stone are occasionally found by the children, or in working the fields. The writer saw no traces of stone manufacture along the coast, or in the mountains of Huarochirí.

Late in the afternoon of the same day, a narrow but at this time of the year dangerous river was passed, the most southern affluent of the Rio Nasca. On the subordinate elevations just to the north of the river were seen crude stone ruins, evidently untouched, of a moderate-sized settlement, with some burials; and that night another remarkable fortified hill was reached, known as Llaxwa.

The *Llaxwa* ruins (pl. 17) consist of stone remains of terraces, fortifications, and dwellings. The hill which they cover is easily approached from the east, but dominates the lower mountainous land on all other sides. The ruins are in a poor state of preservation; it is seen however that they have not yet been thoroughly despoiled and contain some untouched burials. The stone masonry, while showing care, is not of high order. No cement was used, and there are no imposing edifices. At the distance of about half a mile to the east from these stone structures, on high sloping ground, exist two groups of burial houses, not as long, but otherwise considerably like those described before from the district of Huarochirí (pl. 18). Unfortunately, these houses have been visited long ago by the treasure hunters, who have left little except fragments of the bones; nevertheless by excavation numerous specimens could probably still be discovered. The remains of the crania show without exception the "Aymara" deformation. A few huts about the Llaxwa ruins are now occupied by Quechua speaking mixed breeds, who seem to know nothing about the history of the locality.

## VI. EXPLORATIONS IN THE NASCA REGION

From Llaxwa, a hard day's journey brings one to the Hacienda de Las Trancas, on a river of that same name but which later on joins the Rio Nasca. It is from this road that one appreciates best the dominating nature of the fortress. The country traversed is dry and no other remains of ancient settlements are met with until one reaches the narrow rocky valley of the river. There in numerous localities are seen stone foundations of ancient dwellings, made of large water-worn stones; despoiled burial pits lined with stones; and on a few large blocks of stone there are petroglyphs resembling remarkably those common to North America.

The above remains are, however, rather unimportant; the archeological wealth of the Nasca region commences at the Hacienda de Las Trancas. The main road of this large estate passes in several spots across remnants of ancient habitations and burials, and numerous cemeteries that have yielded quantities of fine pottery are in the vicinity. Skulls, bones, fabrics, and other objects are strewn in patches over the desert outside of the arable lands of the shallow valley. A group of these cemeteries at a locality known as *Poroma*, about three miles southwest of the hacienda, were examined later.

From Las Trancas the writer proceeded to *Majoro*, one of the haciendas of his friend from Lomas, Sr. Enrique Fracchia, and located only a short distance below the town of Nasca. From this place limited excursions were made farther up and down the valley of Nasca, and also to the above-mentioned *Poroma*. Subsequently the river was followed to considerably below where it merges into the Rio Grande. What was learned during the rapid survey of these regions was briefly as follows:

Ruins of importance are found in the vicinity of Nasca, but remains of small settlements exist at many spots along the edges of the sandy plains bordering the arable lowlands. In a number of instances posts of the hard and enduring huarango (mesquite) indicate the presence of habitations, while other posts of the same wood, standing in rows, subserved functions not yet determined.

Along the various branches, as well as by the main stream of the Rio Grande de Nasca, in the deserts, beyond the cultivable ground, there are numerous old cemeteries, some quite extensive, but the majority of small size. A great deal of excavation has been done in these cemeteries, particularly during the recent period of drouth, when, according to local reports, they proved a "god-send" to the poor people.



Fig. 1. The hill from the northeast

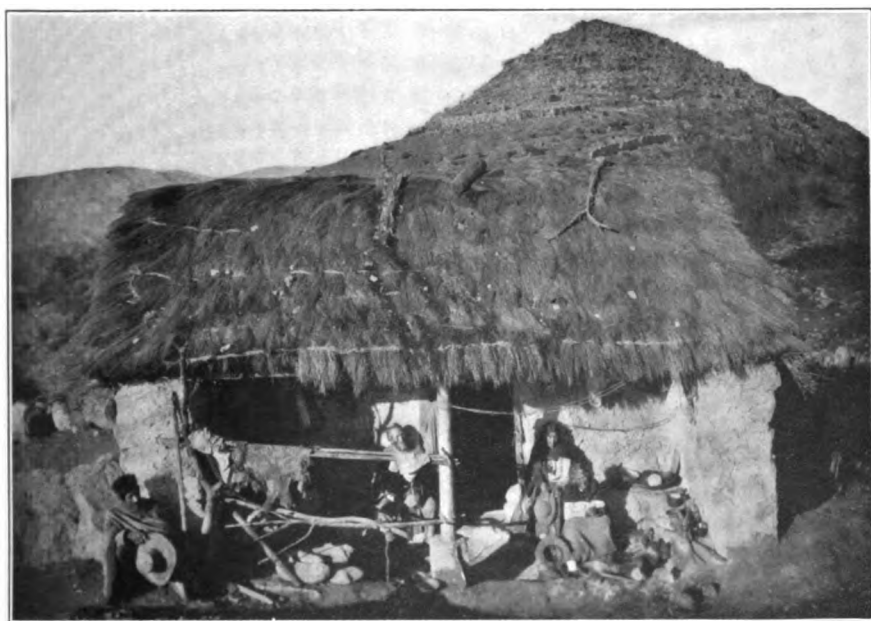
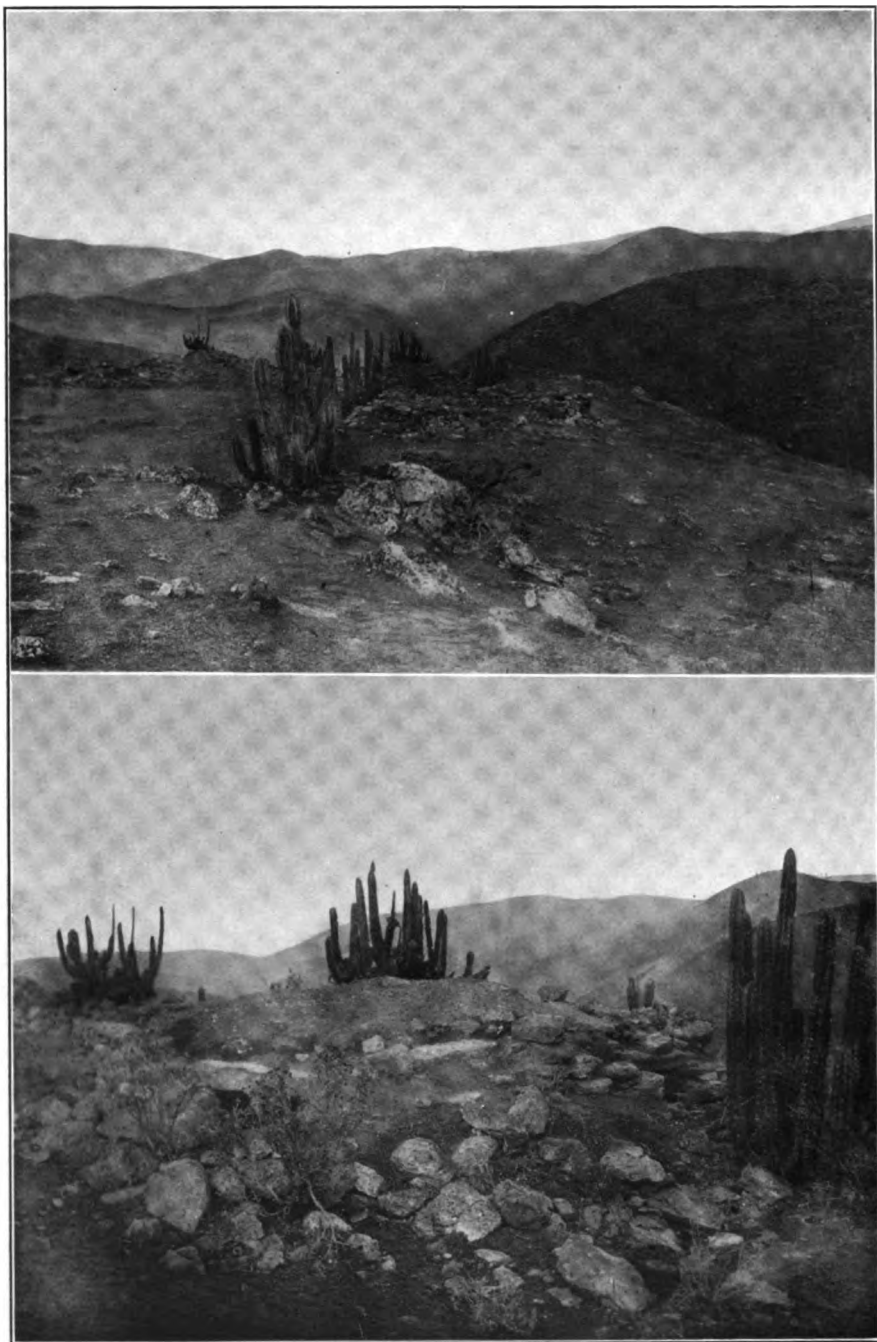


Fig. 2. The hill from the southeast. Native hut, for the moment the writer's quarters, in the foreground. The inhabitants are mix-breeds, speaking Quechua

THE FORTIFIED HILL OF LLAXWA, ABOUT 50 MILES (BY THE PATHS) S. E. OF NASCA



BURIAL HOUSES A SHORT DISTANCE EAST OF THE ANCIENT FORTIFIED HILL OF LLAXWA, IN THE WESTERN CORDILLERA, S. E. OF NASCA

Throughout these regions there are found with the burials not only excellent potteries of the Nasca type, but also, though to a less extent, nicely decorated fabrics, even feather work, and now and then articles of gold. It was the indiscriminate digging for and the sale of such articles, that sustained for two years the poorer part of the Nasca population. Since the law was enacted prohibiting such exploitation it has been greatly reduced, but irreparable damage to scientific investigation has already been done. The objects taken from the graves have been distributed broadcast, in the main to private curio collectors. And there are at the present time individuals who keep on excavating the remaining graves and hunting for whatever may be salable, some of them periodically and a few daily. Good pieces of pottery bring on the spot as much as a pound (\$4.90); the gold objects are sold usually by weight, and the fabrics for whatever they will fetch. A great deal is broken or torn and left, so that the total loss is enormous. Some of the more recently excavated burial places were found, as at Lomas, almost covered with remnants of fabrics, slings, ropes, and even scalps with peculiar braids, of all of which it was still possible to secure a good-sized collection; but it would be very costly at this day to make anything like a first-class representative gathering showing the Nasca culture.

The burials of the Nasca region are of several varieties, which however are in the main closely connected and do not indicate separate periods or cultures, or different types of people. The tombs seen over the 40 odd miles of territory between the haciendas Majoro and Coyungo and in the valley of the Las Trancas River, included some low mounds, with chambers built of moderate-sized adobes; ordinary, stone, or sand-block lined pits; subterranean chambers constructed of poles of the hard wood, or of wood and adobes; besides which there were simple graves in the sand or gravel, and finally, in several localities, burials in large, stout, undecorated, earthenware urns, especially made for that purpose. The huarango poles in the graves or burial chambers, as well as in the remnants of the habitations, had generally been reduced to the proper length by burning, but instances also occur in which they had been cut.

The bodies have as a rule been buried in the contracted position, and bound in bundles; and those of important personages were made up, with the aid of abundant raw cotton, into huge mummy-packs.

Physically the population of the entire Nasca region was remarkably homogeneous, which is a fact of considerable interest; and,

what is important, it was possible to determine conclusively that it represents merely a portion of the brachycephalic, moderately developed, coast type of people (pls. 19, 21).

Deformation of the head, fortunately, was much more rare than closer to the coast. What was present was exclusively of the same fronto-occipital variety. Not a single instance of the "Aymara" type came to notice, but it was learned that two or three skulls of that nature were found in one grave at some distance down the main valley. In one case, just above the dwellings of the hacienda of Coyungo, a moderate-sized cemetery was met with in which all the crania were marked by the pronounced fronto-occipital deformation such as was met with in the burial ground to the east of the house at Chaviña.

The oblong type of the skull (pls. 20, 22), which was found frequently in the valley of Acari, was seen only rarely in the region of Nasca. There was less admixture of this type among the people of the Nasca than among those of most of the localities along the coast. However, at *Coyungo* (over 40 miles west of Nasca), two moderate-sized burial grounds were examined in which this oblong type was again in greater evidence.

As regards pathology, the Nasca region compares closely with that of Lomas and the Acari Valley. Fractures were equally rare; symmetric osteoporosis of the skull occurred seldom and not in extreme form; and there were but few "mushroom-head" femora. A number of cases of more ordinary arthritis and a small number of inflammations exhaust the finds in this direction.

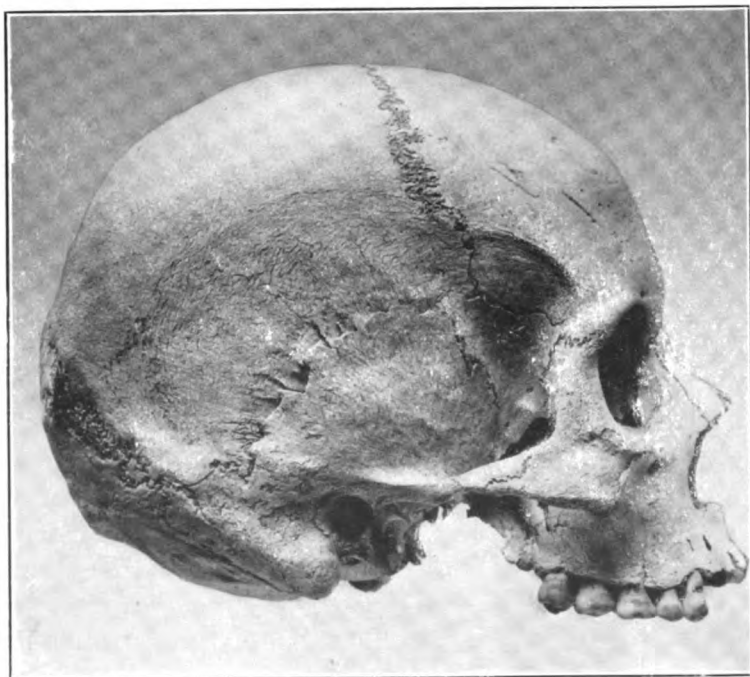
In the deeper burials of the Nasca Valley, the skeletal material, either from age or moisture, is generally in a poor state of preservation, and is almost invariably reduced by those who excavate into fragments; many of which are then reburied. So far as it was possible to examine this class of remains they were seen to be of the same type as those from the more superficial graves, but the fronto-occipital deformation of the skull was more common.

The uneven size of the various cemeteries in this region will be appreciated from the following records:

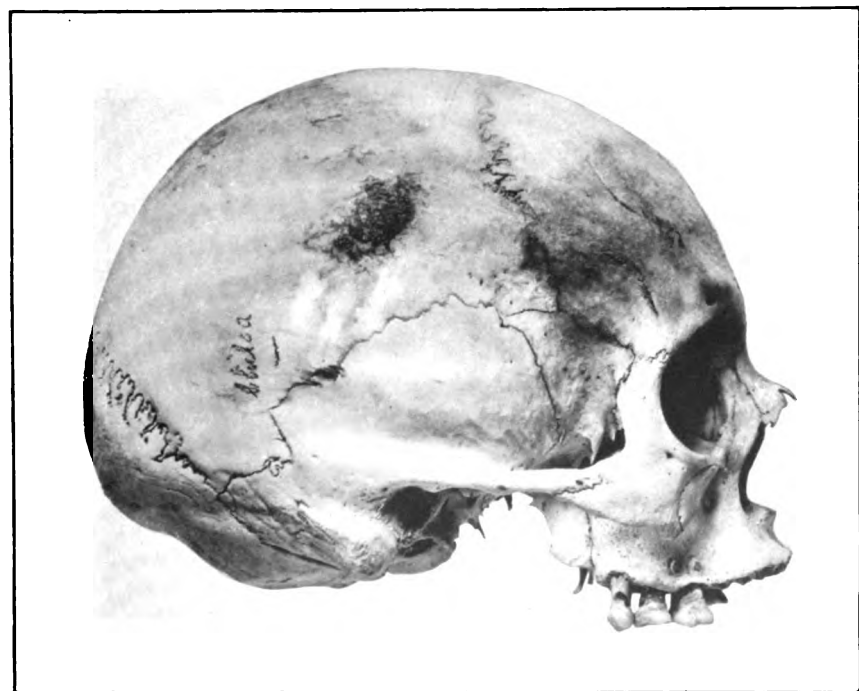
Of the four well-excavated cemeteries at Poroma, six leagues south-southwest of Nasca, the first showed exposed 156 crania and a corresponding quantity of bones; the second 63 crania; the third 101, and the fourth 200 crania. Five smaller burial places at Coyungo gave, the first 72 skulls, the second 34, the third 78, the fourth 9 (with perhaps as many in fragments or reburied), and







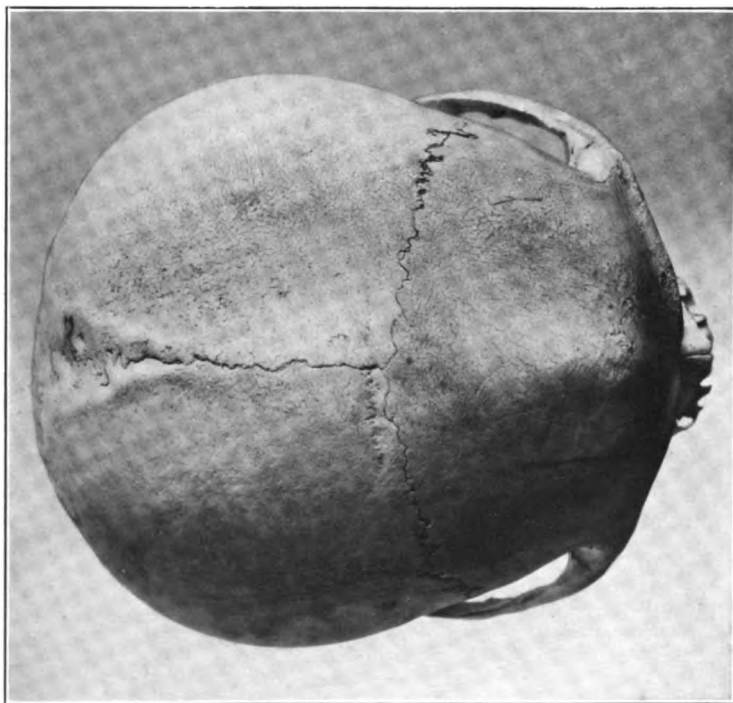
THE TWO TYPES OF SKULLS SECURED IN ANCIENT CEMETERIES ON THE COAST OF PERU: A MALE AND A FEMALE SKULL OF NASCA, SHOWING THE PREDOMINANT BRACHYCEPHALIC COAST TYPE



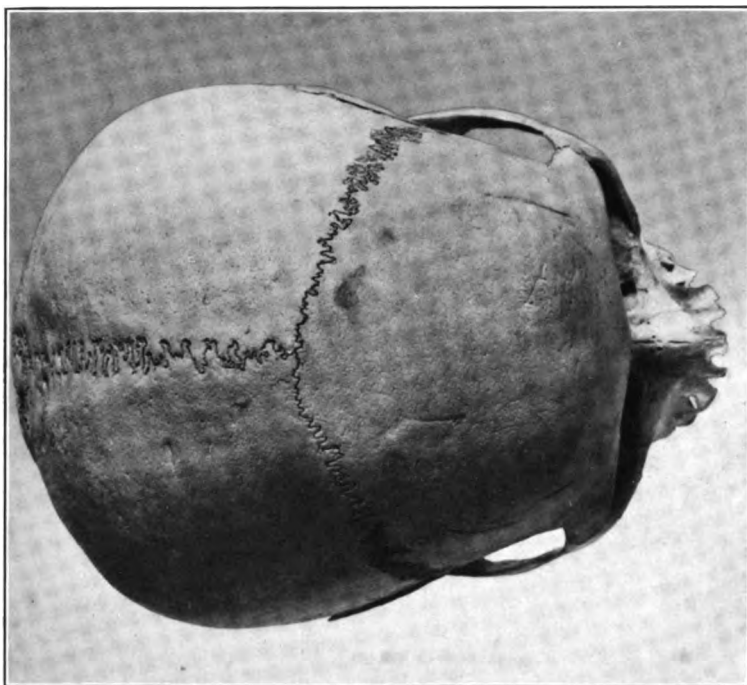
A MALE SKULL (TOP) FROM CHAVIÑA, AND A FEMALE SKULL FROM CHILCA, SHOWING THE MORE OBLONG TYPE OF PERUVIAN CRANIA, WHICH OCCURS IN MINORITY ALONG THE COAST BUT PREDOMINATES IN THE WESTERN PARTS OF THE MOUNTAINS





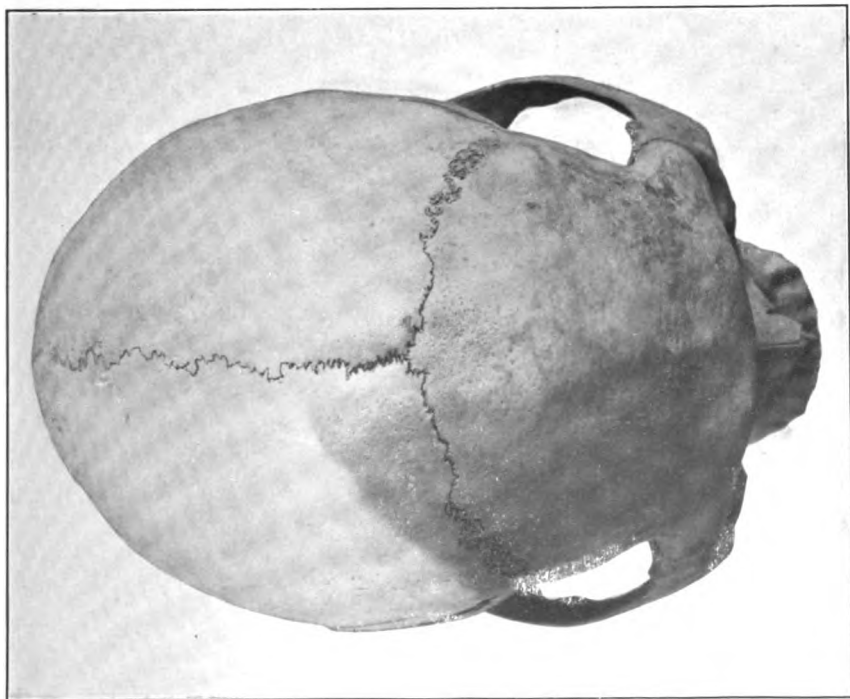


Male

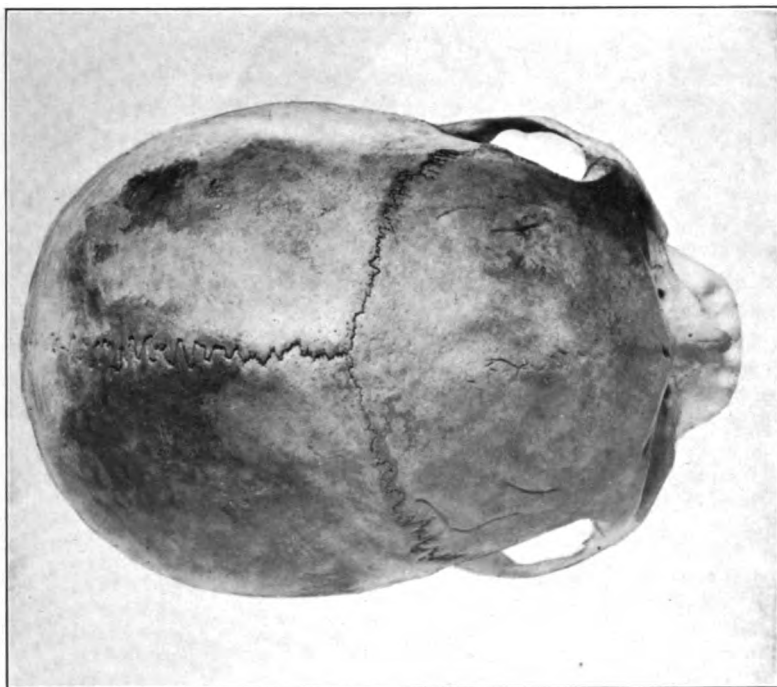


Female

THE TWO BRACHYCEPHALIC SKULLS SHOWN IN PLATE 19 FROM ABOVE

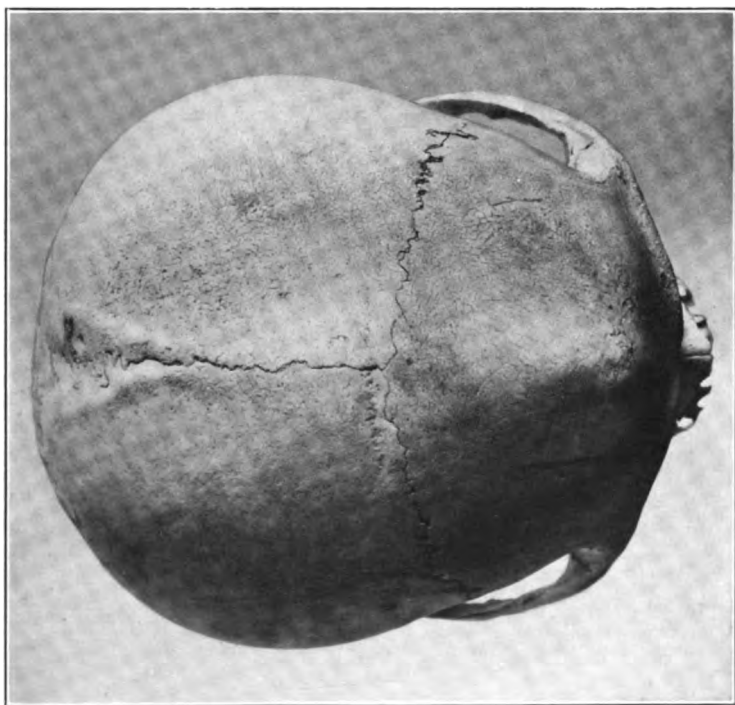


Male

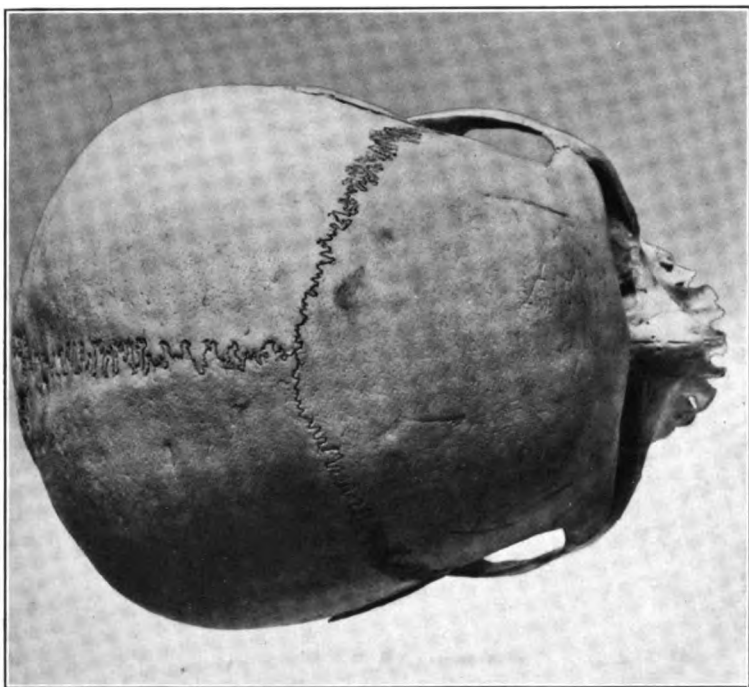


Female

THE TWO DOLICHOCEPHALIC SKULLS SHOWN IN PLATE 20 FROM ABOVE



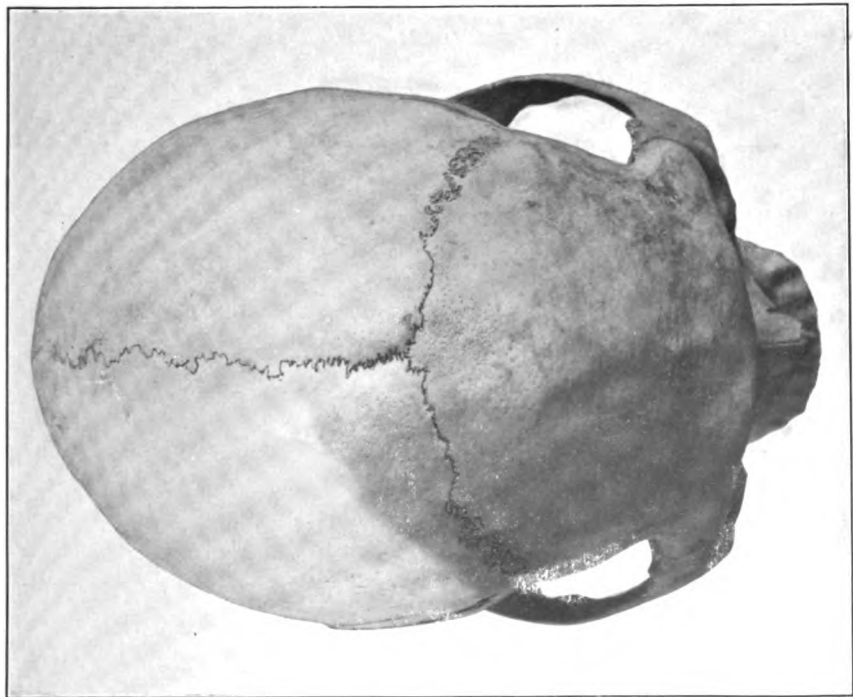
Male



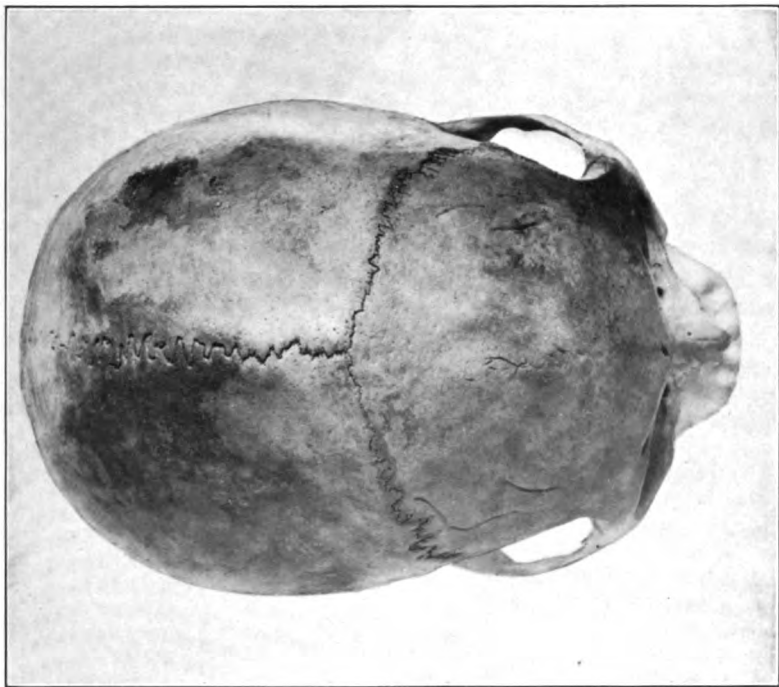
Female

THE TWO BRACHYCEPHALIC SKULLS SHOWN IN PLATE 19 FROM ABOVE





Male



Female

THE TWO DOLICHOCEPHALIC SKULLS SHOWN IN PLATE 20 FROM ABOVE



the fifth 23. But in each case some addition must be made for skulls accidentally reburied and for a few that may have escaped discovery.

Owing to lack of time, the shorter more eastern part of the Nasca Valley could not be visited, and the same is true about the watersheds of the northeastern branches of the Rio Grande, all of which are said to contain cemeteries as well as other remains of antiquity.

The burial grounds on the lands of the hacienda of Coyungo represented, as indicated above, in a large measure the Nasca people and Nasca culture. The pottery at the hacienda, of which a collection was seen, was also in the main of the Nasca type, with some aberrations. Finally the cotton-bale mummies were rather common (pl. 23, fig. 2).

*Coyungo-Ica-Pisco.*—The distance from Coyungo to Ica is estimated at over 80 miles, and up to about 25 miles from Ica the road passes over hot barren deserts, which show few traces of the ancient population. At the point just indicated, the road reaches the hacienda of *Ocucaje*, a large, shallow, green depression. At a number of sites on the outskirts of this depression are seen mound-like elevations which possibly contain remains of habitations and show burials. At one such place a number of defective skulls on the surface were found to present the interesting highly deformed "flat-head" variety, such as seen before in one of the cemeteries at Chaviña and in two near Coyungo. The bones belonging to these skulls showed also the same moderately developed people as were found in the other cemeteries just cited, and as were general along this part of the coast.

A brief stop was made at this hacienda and one of the owners demonstrated to the writer a collection of various objects recovered from the local burial grounds. These specimens, while showing in many points a relation to the Nasca culture, presented a number of differences. Thus for the first time on the coast there were seen bows and arrows. Both were of large size. The bows were simple. The arrows were made of reeds and had long wooden points barbed on one side. A kind of a colored palm-fiber basketry was seen, representing possibly parts of a head gear. The pottery, while showing numerous resemblances to the more ordinary types of the Nasca region, differed from the latter by the absence of certain shapes and in decoration. Furthermore there were signs of wood carving, which is only rarely met with about Nasca. Feather work

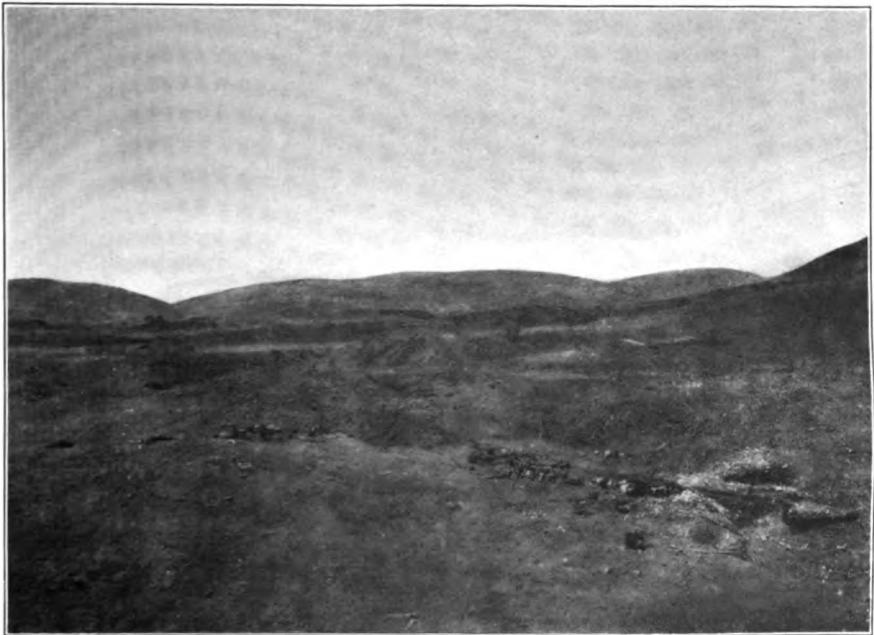
was present, but of simple design, and even this was said to be rare in this vicinity.

From Ocucaje the road leads over a swell in the ground to the valley of Ica. Just where the road enters that valley, a low artificial elevation was seen and the ground in the neighborhood was strewn with skulls and bones, for the most part very defective due to long exposure. The type of the crania and bones was that of the ordinary coast population, and the majority of the skulls presented more or less of a fronto-occipital flattening.

In the valley of Ica, thickly overgrown by the huarango, a number of localities were heard of at which there were old burial grounds, and traces of ruins, or huacas; but evidently none of these are of great size or much importance. On the day following his arrival at Ica, the writer, with the kind assistance of the prefect of the district, made an excursion to a rather large mound and cemetery located at *Chalcaca* (or *Chulpaca*), near Pueblo Nuevo, about five miles southeast of Ica. The place was found thoroughly dug over by the peons, and the work was evidently completed a number of years ago, for the skeletal remains were in poor condition. The burials, or at least some of them, were made in large cylindrical earthenware jars or urns, about two and a half feet high and nearly the same in diameter. A number of these jars, not unlike the sections of a huge sewer-pipe, lay about one of the neighboring huts, apparently too substantial to be broken and too large to be made any use of by the present people. The skeletal remains showed a prevalence of the ordinary coast type people, with moderate fronto-occipital deformation of the skull; but there was a very perceptible admixture of the more oblong-headed element, well known from other places referred to in this report. At the house of one of the wealthier men of the neighborhood was seen a collection of pottery and other objects, showing the ancient culture of this vicinity. The specimens resembled closely those of Ocucaje, the pottery, however, showing decoration still more at variance in designs from that of Nasca. A large percentage of the vessels were more or less globular water jars of different sizes, with a narrow neck. The collection embraced very few fabrics, but included 20 or more stout staffs with well-executed carvings at one extremity, and set in the ground in front of the house was a carved post showing an attempt at a representation of a human figure. The bows and arrows were like those at Ocucaje.



**Fig. 1. Some recent excavations in one of the old Nasca cemeteries, showing the abandoned skulls and bones**



**Fig. 2. Excavations at Coyungo, showing a subterranean burial chamber and debris of the cotton-padded mummies**

**ANCIENT CEMETERIES IN PERU, SHOWING THE RESULTS OF THE PEON'S WORK. THE SKULLS, BONES, FABRICS, ETC., ARE LEFT TO DESTRUCTION**



A noteworthy condition in regard to the human bones at this locality was the relative frequency of various pathological conditions of inflammatory nature, and a rather poor development of many of the bones in strength.

The above was the only burial ground within easy reach of Ica that offered any fair prospects for finding skeletal material; and according to information obtained from various sources, no cemeteries or other remains of antiquity of any account exist on the deserts between Ica and Pisco. None are, in fact, said to be found before one reaches the Rio de Pisco, and especially the vicinity of Tambo de Mora and Chincha, which localities the writer was also unable to examine.

## VII. GENERAL REMARKS ON THE LOMAS, ACARÍ, NASCA AND ICA REGIONS

The explorations along these parts of the Peruvian coast and especially those in the Nasca region, have demonstrated beyond any possible doubt that the population of this territory and to the west of the high mountains, was an integral and inseparable part of the coast people. In every respect, even in the occasional admixture of the longer-headed element, this population was identical with that of more northern districts of Pachacamac, Rimac, Ancón, Huacho and Chan-Chan. Its culture differed, however, from that of these districts in many particulars; but it was not homogeneous, differing more or less from spot to spot and even from cemetery to cemetery. The Nasca group, physically the purest, seems to represent the oldest part of this southern coast population.

## VIII. EXPLORATIONS IN THE DISTRICT OF LA LIBERTAD

From Pisco the writer took a steamer northward and, after rapidly arranging matters at Lima, left for Salaverry, 300 miles to the northwestward of Lima and nearly six hundred from Nasca. After reaching Salaverry, he proceeded immediately to the hacienda de Roma in the valley of the Chicama (fig. 3).

It was in the *Chicama Valley* and from the same hacienda, that the writer was able in 1910 to visit 29 old native cemeteries and to make an important collection. Over 1,200 crania and a large quantity of other bones of the skeleton were secured on that occasion; nevertheless the region had by no means been exhausted of specimens, or

scientifically. In particular, a number of pathological problems remained to be settled and made further investigations very desirable.

Fortunately for the work, the writer gained the friendship of the most influential as well as enlightened man of the Chicama Valley, Senator Victor Larco, and the aid of this gentleman, with that of those who have charge of his estates, made it possible to accomplish what otherwise would have required much more time, and might even have been impracticable. On this occasion at the writer's wish and before his arrival, Sr. Larco detailed a number of his employees to collect everything in the line of skeletal remains that was exposed from one of the large prehistoric cemeteries, not before examined, near the hacienda of Chiquitoi, and from several other localities. As a result when the writer arrived, he found the floor of a spacious hall in the local hospital piled with skulls and bones, a material on the whole in a rather poor state of preservation, but making possible some statistical determinations, particularly in regard to pathological conditions, for which there was formerly no occasion. The results of these are given in the appendix to this paper.

The work at Roma concluded, the writer made an interesting visit to a large huaca and a cemetery on the Casa Grande hacienda, and then proceeded toward the seashore, where a number of burial sites were investigated. He came unexpectedly across an exceptional burial ground near Huanchaco; examined once more the cemeteries about the Cerro de la Virgen; found another remarkable cemetery on the edge of the slightly elevated Chan-Chan plateau about two miles south of Huanchaco; examined two large and one small cemeteries at Chan-Chan; passed over the burial grounds in the edge of the desert from Moche to the huacas of the Moon and the Sun; and finally nearly completed the circle about Trujillo by making a journey to the eastward and northeastward of the town, following the ancient acequias and walls. A more detailed visit than was formerly possible was also made to the great Chan-Chan ruins.

The results of these explorations in the La Libertad district may be briefly summarized as follows:

Since the writer's visit to many of these places three years ago, a very perceptible change for the worse was observed to have taken place in the state of preservation of the old remains. Also, where formerly were seemingly inexhaustible quantities of skeletal material,



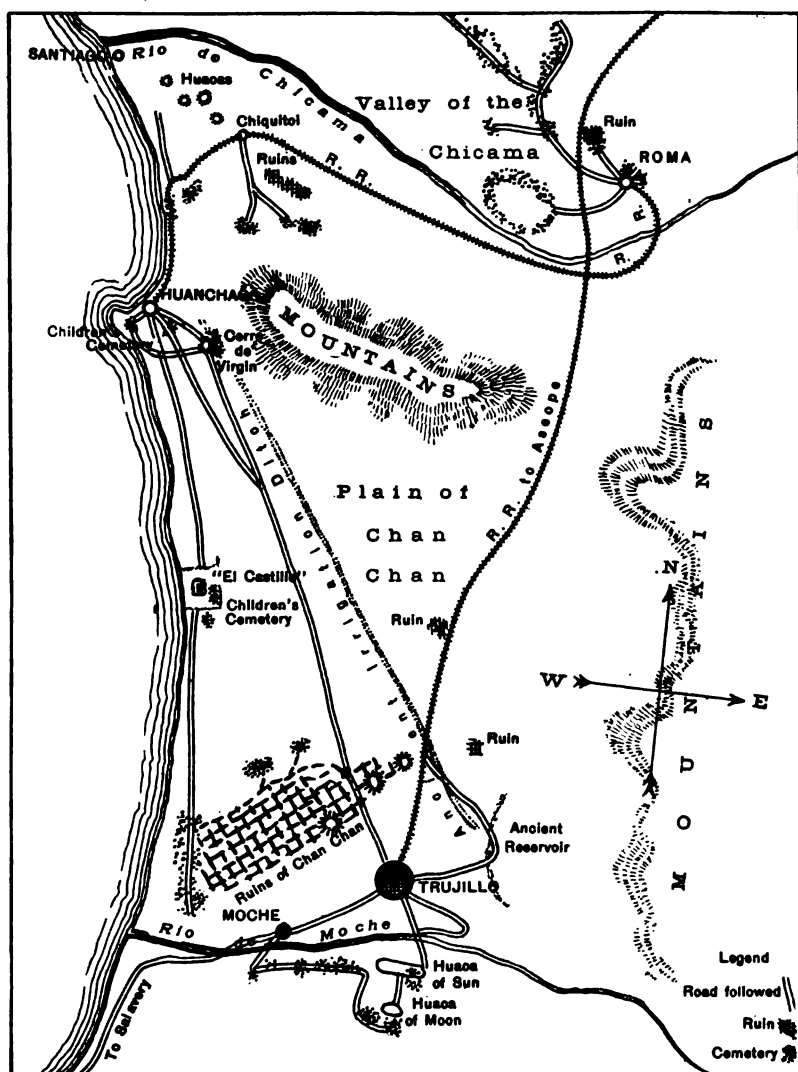


FIG. 3.—The environs of Trujillo and the Valley of the Chicama. Sketch showing the territory examined by the writer and approximate location of a number of the ruins and cemeteries.

there is now a dearth of the same. No such collection as that made in 1910 will ever again be possible from these regions, and had the material not been gathered at that time, it would be to-day for the most part unavailable, due to atmospheric destruction.

As on the occasion of the former visit, so now, the major part of the ancient population of the Chimú region was found to belong to the more or less brachycephalic coast type, of moderate stature and moderate to (close to the coast line) strong muscular development. The valley of the Moche River, the cemeteries about and on the huacas of the Sun and Moon, and Chan-Chan itself, show a population identical with that of the Chicama Valley; and this population is of precisely the same type as that of Huacho, Ancón, the Rimac Valley, Pachacamac, Lomas, Acarí Valley, and of the Nasca and Ica regions. These conclusions it is now possible to state definitely.

As elsewhere along the coast, the Chimú people were wont to practice, though not with equal frequency or intensity at all periods of time or among all their subdivisions, the antero-posterior head deformation. Even those cases which formerly appeared to the writer as being simple occipital flattenings are, he has now reasons to believe, merely lighter varieties of the "flathead" type; they are cases in which the pressure on the forehead was inadequate to cause enduring changes in that region, nevertheless was sufficient, coupled with the weight of the head of the infant, to produce a flattening of the occiput.

As many other localities along the coast, so also the Chicama and Moche valleys, as well as the Chan-Chan region, show more or less admixture, the proportion differing from cemetery to cemetery, of a more oblong-headed element of the same type as that met with in the mountain region of Huarochirí. But it seems very probable that this type was in the main of a relatively late appearance. It is rare among what appear to be the oldest burials; and it manifests itself in mingling, or living side by side, rather than admixture. This type evidently brought with it differences in culture, including the absence of the habit of head deformation, which however was in part adopted later. The occurrence of this type, which can represent no local variation and which is very scarce among or absent from the oldest Chimú as well as Nasca burials, indicates late prehistoric relations, more or less extensive according to locality, with the highland people who carried it, and a considerable subsequent intrusion of these people into the coast settlements. Quite likely exploration in

the mountains will show all along the line similar intrusions of the people of the coast type into the hills.

A number of especially interesting particulars resulting from these later studies in the Trujillo and Chicama regions, were as follows:

At the cemetery near a large huaca on the lands of the hacienda *Casa Grande*, while a larger part of the burial ground yielded nothing but the coast type of people, a small collection showed a taller and better developed strain with large and beautifully oblong skulls, free from all deformation.

On a promontory of the elevated flats rising a short distance south of *Huanchaco*, a moderate-sized burial ground was found which, with the exception of one or two adult individuals, yielded nothing except the skulls and bones of children and young adolescents, and the crania of these belong without exception to the fine, oblong, undeformed type, such as was found near the above-mentioned *Casa Grande* ruin. The cemeteries north and east of *Huanchaco* showed the usual coast type of people.

A little over two miles south from *Huanchaco*, at the edge of the elevated and in the olden times cultivated, but now desert, plain of *Chan-Chan*, a double, quadrilateral, isolated enclosure exists, which has been regarded by some as the remains of an old castle or fortification (see fig. 3). Instead, this relatively simple structural unit was a convent, school, or a shelter for more grown-up children and young adolescents, and was occupied by people other than those of the valley, for just outside the walls of the inner enclosure, to the east, exists a cemetery which again, as at *Huanchaco*, yielded nothing but the bones and skulls of the young and the skull in every instance was found to be of the oblong, undeformed, fine variety. Just outside of the wall to the south of this compound were some burials of adults which gave the usual coast crania.<sup>1</sup> No other

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<sup>1</sup> It is doubtless this compound to which Squier (Peru, etc., N. Y., 1877, pp. 122-123) refers as *El Castillo*. But Squier must have written of this structure from recollections that had become somewhat unreliable. The quotation is introduced below. It is certain that the burials mentioned by Squier were not those of young women, but of children and young adolescents of uncertain sex; such skulls, however, can easily be taken for skulls of women by one who is not an anatomist. Also, there are no traces of the "several acres stuffed with skeletons"; the large exposed *Chan-Chan* cemeteries exist farther southward. Finally, skulls showing traumatic lesions are common in many parts of the coast. It is certain that nothing now indicates that any battle has taken place in this locality. Of course, the skeletal

occurrence of a similar grouping of the oblong-headed type was met with in these regions, nor anywhere else along the coast.

The *Cerro de la Virgen* cemeteries and neighborhood were again examined and it was definitely determined that this small rocky eminence has never been fortified; that the cemeteries about it are just ordinary burial grounds of rather poor people of the coast type; and that the neighborhood was in olden times irrigated and cultivated, the remains of a large, deep ditch leading for miles to the eastward and terminating in a reservoir, now dry, east of Trujillo.

The cemeteries of *Chan-Chan*, to the north and northwest, are still to a large extent unexplored; however, digging by the peon goes on. Those immediately to the west of the ruins have by this time been quite dug over. There are stores at Trujillo, including the principal pharmacy, which openly buy and in some instances sell the "wares."

It is strange that this great ruin, the center or rather culmination of the Chimú culture and as such one of the most important archeological remains of ancient Peru, also one of the sites most dug

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remains exposed 35 years ago have in all probability completely disappeared, but the peons generally keep on excavating in such localities turning up new specimens. Squier's note reads: "We took a long sweep past La Legua to an eminence near the sea, on which stands an extensive work with a *huaca* and other monuments inclosed, called, from its position and assumed purpose, El Castillo. The sandy soil in front of its principal entrance, over an area of several acres, is stuffed with skeletons, buried irregularly, as if after a great battle; a supposition supported by the fact that the bones which had been exposed by excavation or laid bare by the winds were all of adult men, and that a large part of the skulls bore marks of violence. Some were cloven as if by the stroke of a battle-axe or sabre; others battered in as if by blows from clubs or the primitive hammer to which the French have given the appropriate name of *cassetête*; and still others were pierced as if by lances or arrows. I picked up a piece of a skull showing a small square hole, precisely such as would be occasioned by the bronze arrow-heads found here and there among the ruins.

"I could not resist thinking, in spite of tradition, that perhaps on this very spot had been fought the last decisive battle between the Inca Yupanqui and the Prince of Chimú, and that here were mingled the bones of the slain of both armies: a notion supported by finding mixed together the square, posteriorly compressed skulls of the peoples of the coast, the elongated skulls of the Aynaras, and the regular, normal heads of the Quechuas of the sierra.

"Inside the Castillo we found a terraced cemetery, containing, however, only the skeletons of young women, carefully enveloped in a fine cotton cloth. These skeletons were apparently of persons that had died at between 15 and 18 years of age."

over by treasure hunters, has to this day received scarcely any scientific attention.

While visiting the ruins of Chan-Chan themselves, one is struck by the enormous labor and expense undergone by the excavators hunting for gold; and the fancies of many an inhabitant in the valley still dwell upon hidden treasure. Also, to one who has seen them before, the fact is sadly apparent that these ruins are undergoing a gradual decadence. The bas-relief palace was revisited. The figures on its walls, stamped in resistant adobe, and which were still beautifully clear three years ago, are to-day already blurred by the action of the elements; a few years more and they will be so much shapeless dry mud, and not a cast or a fragment of them exist anywhere in a museum. Similar examples of the ravages of time could be multiplied in this great city.

The cemeteries of the *Moche Valley* are now evidently almost exhausted; but burials are said to still occur in the sand hillocks from Moche to Salaverry. The burial grounds about the huaca of the Moon have been thoroughly dug over and seem also to be quite exhausted. The excavations in the huge adobe pile which began a few years ago under the direction of the then prefect of Trujillo and another high public official, Dr. Portugal, have evidently been carried somewhat further, but so far as learned without adding much to the results of the first digging. The great huaca of the Sun has been injured no further. Undisturbed burials doubtless still exist about and on, as well as in, this immense structure. A skeleton of a woman, which the writer secured, has been recently dug out from a small flat near the top.

The skeletal material examined or gathered from all these places duplicates, as already indicated, that from the valley of the Chicama, and offers similar pathological conditions. The four principal classes of lesions found in the Chan-Chan region include symmetric osteoporosis in the young; the "mushroom-head" femur; other signs of arthritis; and exostoses in the external part of the auditory meatus. Besides these there were met with a few cases of more or less localized periostitis or osteoperiostitis, one of a destructive bone lesion or tumor, and a few fractures and dislocations.

## IX. GENERAL CONCLUSIONS

During his late expedition to Peru, the writer examined approximately 4,800 crania and a very large quantity of other bones of the skeleton. This material belonged in a large part to the coast region,

but to some extent also to two of the more western districts of the highlands. The investigations were an extension of those of 1910, when, besides the considerable quantity of specimens examined, 3,400 skulls and a large number of bones were collected.

The investigations on both these trips to Peru followed, as already stated in part, three main objects, namely:

(1) The determination of the anthropological characteristics of the pre-Columbian Indian of the coast as well as of the highland regions, so far as these could be covered;

(2) The study of the diseases of the pre-Columbian Peruvian, with a collateral inquiry as to trephining and other possible surgical practices; and

(3) The gathering of any indications that might be found relating to man's antiquity in that country.

The results of the work are not ideal, nevertheless a number of points of value, have been determined. Important parts of the territory could not be reached, and even within the regions attained the exploration had to be limited to what lay exposed on the ground or in the caves. Furthermore, it was difficult to determine the age of many of the burial grounds. Except where clear signs of a contact with Europeans were present the age of the cemetery could only be surmised. Yet it is certain that a large majority were pre-Columbian; and the problems seriously affected by the uncertainty are few in number, and belong only to the realm of pathology and surgery.

*Anthropologically*, the opinions ventured after the conclusion of the first expedition are in the main confirmed. While a few links in the chain of evidence are still wanting, it can now be regarded as quite certain that the Peruvian coast from Chiclayo at least, in the north, to Yauca in the south—a distance of over 600 miles—was peopled predominantly before the advent of the whites by one and the same physical type of Indian. This type was characterized by brachycephaly, moderate stature, and moderate to strong musculature according to localities. The most important facts ascertained in this connection are that both the Chimú and the Nasca were innate and, on physical grounds, inseparable parts of this people.

These coast people were fishermen, or agriculturists, according as they were settled close to the sea or farther inland. Evidently they were organized into numerous political groups, which developed smaller or greater cultural differences according to environment and other influences. It may be permitted to introduce here a few

generalizations, however imperfect, in regard to their cultural life, based on the extensive knowledge obtained of their remains.

They built dwellings of reeds, as well as larger structures of small uncut stones, of moderate-sized sun-dried brick, or of great blocks of adobe, and they constructed of adobe, stones, and earth characteristic larger edifices, and mounds of various sizes, known as *huacas*. The latter probably served partly for ceremonial purposes and partly for burials.

These people were remarkably well acquainted with the arts of weaving, pottery making, and decoration. They wove from the native cotton and from llama wool. The color and decoration of the fabrics, and the shapes, artistic value and variety as well as the symbolism of the decoration of the pottery, differed from place to place, in accordance with time and other influences.

The pre-Columbian Peruvians of the coast knew copper, silver and gold, with some of their combinations, and worked these metals to a limited degree. They dressed principally with a poncho shirt, a loin cloth, and sandals, with little head-gear; what there was of the latter was often decorative or symbolic. They made considerable use of gourds. They made few or no stone implements. They utilized wood in their houses and for ceremonial purposes, in the latter case developing more or less carving. Their weapons were a metal or stone mace, a wooden club, a copper axe, a variety of copper knife, the sling, and in some regions also the bow and arrow. Their implements were the whorl, weaving sticks, looms, cactus-spine or bone needles, bone needle holders, sharpened sticks, copper knives, copper axes, hoes; and in the case of the fishermen, nets, sinkers, reed-bundle boats or balsas, and peculiar rafts, with paddles. In pottery they made frequent use of molds and stamps, and were masters at imitating natural objects and animals as well as man. They knew no precious stones, except possibly, in rare instances, the emerald and the turquoise; and they had no pearls. They used beads, claws, seeds, feathers, multicolored yarn, and metal objects for personal decoration. Nose and ear ornaments, though probably in use, have not been found by the writer in the many cemeteries examined. Their musical instruments were the drum, the pan-pipe, the flute, and the rattle.

Throughout the extent of the territory which they occupied, the coast people deformed the heads of their infants by applying a pressure, probably by means of a bandage and pads, to the forehead, and this practice flattened at the same time by counter pressure the

occiput. The oldest parts of the population, except perhaps at Nasca, seem to have deformed less generally than those just before the arrival of the whites. The frequency and intensity of the deformation differed according to groups and possibly clans, of the people. They practiced no filing, cutting or chipping of the teeth, and no other mutilation which would leave marks on the skeleton. In the Chimú region, there may have been something like the nose-cutting among the Apache and other tribes.

These people of the coast have spread along the valleys to the foothills of the Cordillera, and have probably in some instances penetrated into the mountains. Meanwhile, however, they became in many though not all localities more or less mixed, or rather mingled, with dolicho- or near dolichocephalic elements, which must have come from or across the mountains. In a few instances a cemetery will be found near the coast in which this oblong-headed type predominates or is almost the only one present.

*Pathologically*, so far as shown by the bones, the people of the coast were decidedly freer from diseases than would be an average white population of such numbers. Some systemic diseases well known to us were seemingly entirely absent before the advent of the Spaniards. On the other hand, there existed several morbid conditions which may not be known or are very rare among the whites. The absent diseases were rachitis, osteomalacia, and probably syphilis, tuberculosis, and cancer. The diseases peculiar to the coast, were symmetric osteoporosis of the skull, in infancy and early childhood; a strange progressive arthritic process affecting the head of the femur and the cotyloid cavity in the adult or rarely the adolescent, called here from its most characteristic feature the "mushroom-head" femur (arthritus deformans); and characteristic exostoses in the distal part of the auditory meatus, tending toward its occlusion. There was a great scarcity of fractures, but on the other hand there were everywhere numerous traumatic lesions of the skull, showing fighting and perhaps executions.

Notwithstanding the frequency of wounds of the skull such as would lend themselves to operation, trephining was very rare on the coast, if practiced there at all. The instances found were all at places within easy reach of the mountainous districts where trepanation is known to have been common. As to other operations, in the valley of Chicama two lower limbs were seen, both in the possession of Dr. Velez Lopez, now of Trujillo, in which the foot had been



disjointed from the leg and the limb fitted with a cylindrical wooden pedestal with a cup-shaped cavity for the stump. But no assurance can be had that these specimens are pre-Columbian. As to the treatment of fractures, too few of these were met with to justify any conclusion; in some cases the very good results suggested the use of splints, in others, if any aid was given, it was unsuccessful.

Only a very few crania were found along the coast showing the "Aymara" deformation, hence the people who practiced this must have had a very limited contact with those of the coast, and the possibility is not excluded that such contact was post-Columbian.

As to the *mountain people*, conditions differ between the two territories visited, namely, that of the district of Huarochirí, and that southeast of Nasca. The Huarochirí district, and doubtless the neighboring parts of the sierra, were peopled predominantly by the oblong-headed type of the Indian, such as found mingled in various proportions with the coast population. Besides this, there was also a proportion of broader-headed people, possibly derived from the coast. The material culture was relatively poor, except as regards agriculture and to some extent weaving; and with the exception of a few examples of the fronto-occipital flattening, there was no head deformation. In the region southeast of Nasca, on the other hand, while some burial places showed apparently the coast people, others gave exclusively those with the "Aymara" deformation, though probably not of "Aymara" descent.

In both regions the mountain people were characterized by a good average development of the body as well as of the skull, and by a great freedom from disease. Facts of especial interest are that there was a complete absence of the symmetric osteoporosis, of the "mushroom-head" femur, and also of the auditory exostoses, in both territories. In the Huarochirí district, where injuries to the cranium were not fatal they were followed in many cases by the operation of trepanation. This, though often large and quite crudely done, was evidently in many cases successful. The practice in all probability persisted to and even after the coming of the Spaniards. In the mountains southeast of Nasca, wounds of the head were scarce and no clearly recognizable instances of trepanation were discovered; one such instance was, however, reported from a place a day's journey to the southeast of the farthest point reached by the writer. Of other surgical procedures there were no traces either in the hills to the north or those to the south.

*Antiquity.*—As to the third main object of the expedition, namely, the search for evidences of man's antiquity, the results were wholly negative. Aside from the cemeteries or burial caves of the common coast or mountain type of people, and their archeological remains, there was no sign of human occupation of these regions. Not a trace suggesting even distantly something older than the well-represented pre-Columbian Indian was met with or heard of anywhere; and the coast or mountain population itself cannot be regarded as very ancient in the regions which it occupied, so far as these were studied. There are no signs that any group has been in any of the sites for even as much as, say, 20 centuries; nor does it seem that any of these people have developed their culture on these spots, except in some particulars due to environmental opportunities or requirements.

As to the density of the pre-Columbian population in Peru, there are plain indications that in numerous localities it was greater than at the present time, while in others it probably was less. However, the burial grounds as well as the ruins offer everywhere plain evidence that they are not contemporaneous, though the differences in their age may often not be very great. The population changed, new groups superseding others. Some of the ruins were doubtless such long before the advent of white man, while others, including the great Chan-Chan, were probably in decline, if not fully abandoned, when the country was entered by the Spaniards. In one word, as among the North American Pueblos, nowhere was the aboriginal Peruvian population at any time as great as the relatively numerous cemeteries or ruins might lead one to suppose, for these burial grounds and ruins date from different, though not far distant, periods.

*Future work.*—In closing this report, the question naturally presents itself as to what remains to be done in Peru in the lines followed by the writer. The answer is—the work recorded here, while to some extent establishing a foundation, is far from sufficient. Similar investigations and collections wait urgently on the anthropologist in the districts of Piura, Eten, and Moquegua, on the coast; in the western sierras from the neighborhood and latitude of Cajamarca to those of Arequipa; and in the eastern highlands from Tiahuanaco to Moyobamba.

The four most important problems in Peruvian anthropology that await their solution are (1) The derivation of the coast brachycephals; (2) The extension and connections of the mountain type or types;

(3) The extension and exact physical characteristics of the Aymara; and (4) The physical identity of the Quechua. Besides this it will be of great importance to determine archeologically the exact relations of culture to the physical type of the people. The writer must repeat again what he wished to accentuate in his former report, that, due to the lack of scientific supervision of the vast majority of the excavations practiced in Peru to the present date, the actual archeological collections from that country in the museums are little more than so many curiosities, which for the most part it is impossible to refer either to any definite people or period. For some time there was hope that the work of the National Museum at Lima would throw light on these subjects; but that work has stopped and lately the museum, so far as anthropological and archeological interests are concerned, has much retrograded. It is earnestly to be wished that the Peruvian Government might assist anthropological investigations in its extensive territories, and especially that it might itself do everything in its power, before it is too late, to gather the data and material which are of fundamental importance to the American anthropologist.<sup>1</sup>

## X. APPENDIX A. SPECIAL NOTES ON SOME OF THE PATHOLOGICAL CONDITIONS SHOWN BY THE SKELETAL MATERIAL OF THE ANCIENT PERUVIANS

### SYMMETRIC OSTEOPOROSIS OF THE SKULL

A peculiar disease, or a manifestation of a disease, occurring quite commonly in infancy among the prehistoric Peruvians of the coast (pl. 24). Found by the writer in 1910 at Pachacamac and Chicama, and at all other parts of the coast that were examined in 1913. It was absent in the mountains, and along the coast its frequency and perhaps its grade differed from locality to locality.

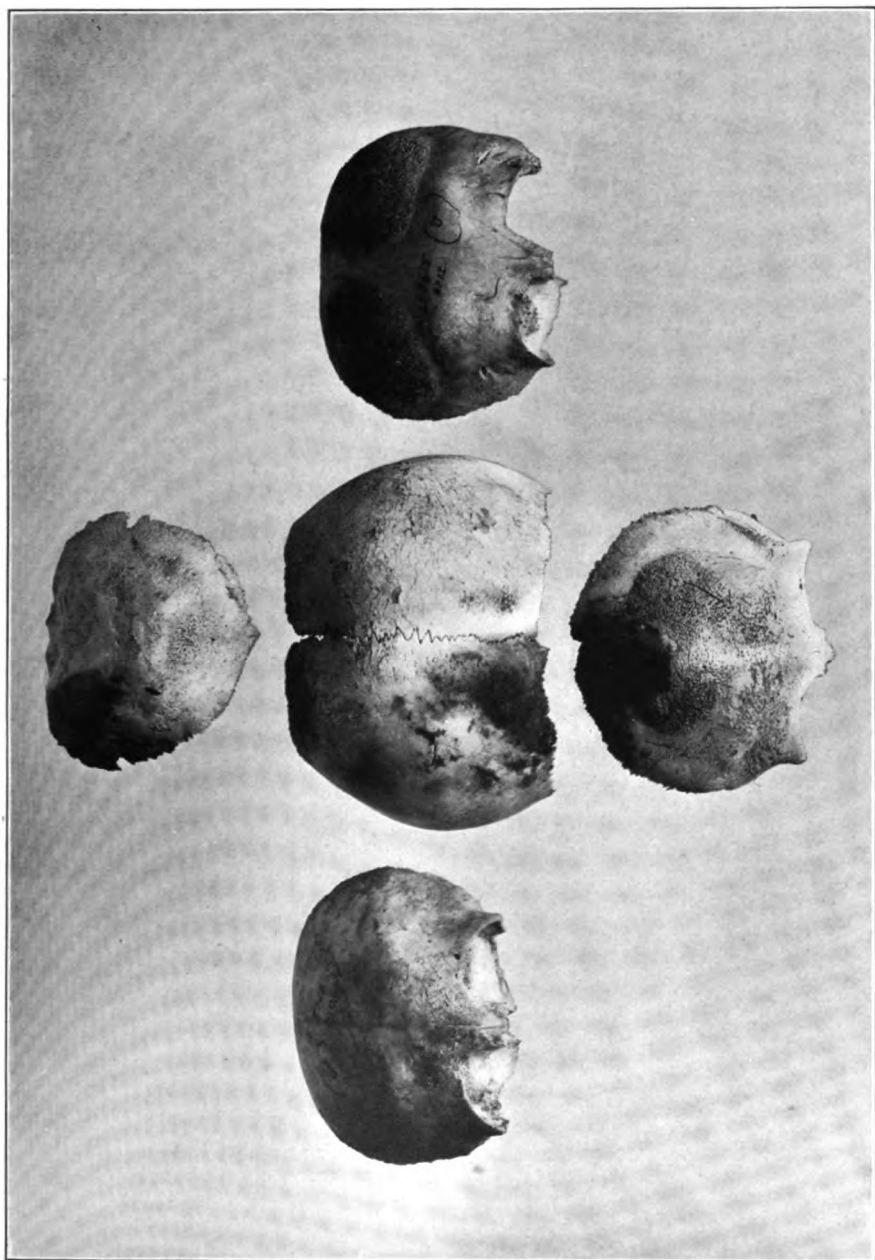
This condition of the skull began to manifest itself in infancy or early childhood. The osseous changes were, so far as could be determined, limited to the cranium, all other parts of the skeleton remaining normal. In all probability they represented not a local

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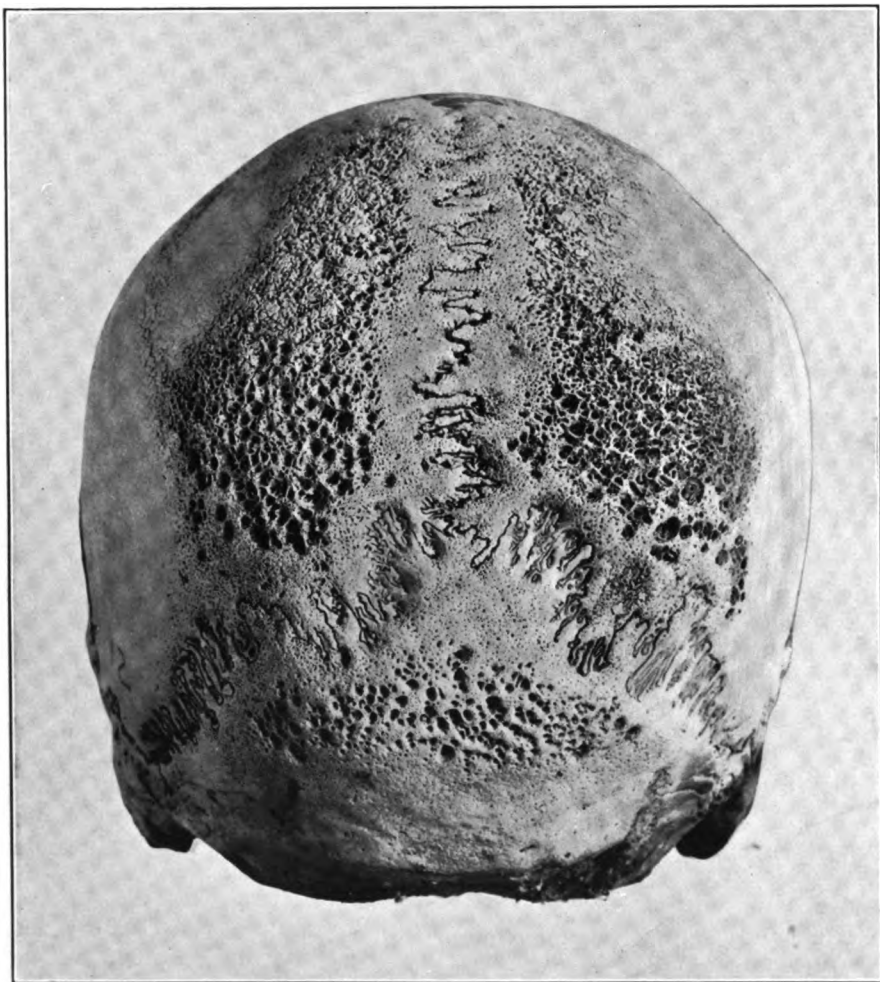
<sup>1</sup> Since the above was written the welcome news has reached the writer that by a decree of the President of Peru, the Anthropological and Archeological parts of the Museo Nacional have been separated from the Historical and placed in charge of the energetic young Dr. Julio C. Tello.

disease, but an indication of some systemic disorder, and this was more likely of toxic than of nutritive or degenerative nature. The disorder was often fatal and that mostly before the changes in the skull reached their maximum; but in a fair percentage of cases the subject recovered. The changes on the skull were characterized by considerable symmetry, by limitation to a very large extent to the outer surface, by invasion of only those parts which do not give attachment to muscles, and by the avoidance of the sutures as well as the facial portions, thus differing radically from such diffuse osteoporoses as described in apes by v. Hansemann. The process began, as can well be seen from the numerous specimens, in the roof of the orbits, or on each side of the frontal squama, between the frontal tuberosity and the coronal suture. In the orbits it began by an increase of vascularity, followed by deposition of porous tissue, which in extreme cases came to look exactly like a low growth of coral. On the frontal the first changes were more like those of localized periostitis, but eventually led also to more or less surface osteoporosis. Following the frontal, more exclusively osteoporotic manifestations developed on the posterior portion of each parietal, between the temporal crest and the sagittal suture, and on the occipital above the crest (see pls. 24, 25). If the condition still advanced, then the wings of the sphenoid, parts of the temporals and parts of the base with the palate began to show signs of proliferation and fine osteoporosis, while localized breaking down of the altered tissue may have taken place in one or more of the older lesions. These were evidently the limits of the bone changes. If recovery took place, there was some thickening of the affected parts of the skull, disappearance of all overgrowths, and a persistence of more or less of a sieve-like condition of the altered surfaces (pl. 25). The rest of the skeleton, as already stated, was either unaffected or affected but slightly.

The condition here briefly described was not rachitic, for rachitis did not exist in the pre-Columbian Indian. It cannot be assumed to have been syphilitic, for in no case were there any other manifestations present that would point to that disease, and its clinical picture does not correspond to that of hereditary syphilis in the infant—there were no nodes nor any intracranial lesions on any infant's or child's head among the many examined, whether with or without osteoporosis, and the recoveries left results unknown in syphilis. Nor was it a part of a tuberculous affection, for the lesions differ greatly from those of this disease. The only conclusion the writer can



PARTS OF THREE SKULLS OF INFANTS, SHOWING LESIONS OF SYMMETRIC OSTEOPOROSIS. THE MIDDLE SKULL IS FROM AN ANCIENT BURIAL NEAR HUACHO, PERU WHILE THE TWO FRONTALS ON SIDES ARE FROM PREHISTORIC PUEBLO CEMETERIES IN ARIZONA



ADULT PRE-COLUMBIAN MALE SKULL FROM THE VALLEY OF THE CHICAMA, SHOWING RECOVERY FROM AND THE REMAINS OF SYMMETRIC OSTEOPOROSIS IN INFANCY

reach in regard to this symmetric osteoporosis is that it represents a process not well known in the pathology of the white race, though perhaps not limited to the ancient Americans.<sup>1</sup>

#### EAR EXOSTOSES: OSTEOMÆ OF THE TYMPANIC RING

A relatively large proportion of the pre-Columbian people of the more central parts of the Peruvian coast suffered, as shown by the skulls, from a greater or lesser occlusion of the external auditory canals by bony tumors. These are generally hard osteomata, from one to three in number, ranging in size from those like a minute drop to those of several millimeters in diameter, mostly rounded or pearl-shape, but occasionally irregular, frequently with enamel-like surface, and situated just within, or perhaps protruding slightly from, the orifice of the osseous meatus. These little tumors, which are associated with no signs of any inflammatory nature, develop invariably from the tympanic ring and particularly from its extremities. They were in no case seen to coalesce, and though they may almost close the meatus they were never seen to do this entirely. Similar osteomata occur, though far less frequently, among the whites; they have been mentioned by Virchow from Peru; and they are found occasionally in the skull of a North American Indian.

#### "MUSHROOM-HEAD" FEMUR: ARTHRITIS DEFORMANS OF THE HIP-JOINT

Never seen in the young, and only once met with in an adolescent. Evidently always of gradual development.

Occurs unilaterally (more frequently) or bilaterally (due to nature of material exact data in this respect not possible).

Sex influence?

Never found advanced to synostosis.

As a rule, without any exception, there were no accompanying changes in the shaft or lower extremity of the same bone, barring an occasional slight to moderate arthritis.

<sup>1</sup> In 1909 the writer brought two infant skulls with a coral-like osteoporotic development in the roof of each orbit from a XIIth dynasty cemetery in Egypt; while Virchow reported (*Verh. Berl. Ges. Anthr.*, 1874, 61-62) similar lesions in a skull of a Pampa Indian from Argentina, and mentions of having seen much the same in the cranium of a young Berliner. It is, of course, possible that such isolated orbital lesions are not homologous pathogenetically with the process described above, but they are of identical character.

Was absent or exceedingly rare in the mountains.

Was less frequent in the south (Nasca region) than in the north (Chimu).

The condition showed many variations. The form changes of the head and neck may reach a fairly advanced stage without a trace of inflammation. Of the more affected specimens there were two principal varieties, one characterized by a great shortening of the neck and a pronounced flattening of the head of the femur, with a shallowness and roughness of the acetabulum; while the other was marked by a deepening of the cotyloid cavity, with less roughness, and the assumption by the head of the femur of a shape much resembling the *caput penis* (see pl. 26). The changes in the acetabulum include in advanced cases the bridging over of the cotyloid notch by irregular masses of bone and a conversion of it into a cavity. Characteristic changes are also observable just above the acetabulum.

Three specimens of the humerus were collected in which the head of the bone underwent similar transformation, *i. e.*, pronounced flattening, spreading and roughening.

#### ARTHRITIS

*Arthritis, Arthritis senilis, A. deformans (ordinary type), Spondylitis deformans*

Conditions not separable in the Peruvian skeleton, differing only in grade and individually.

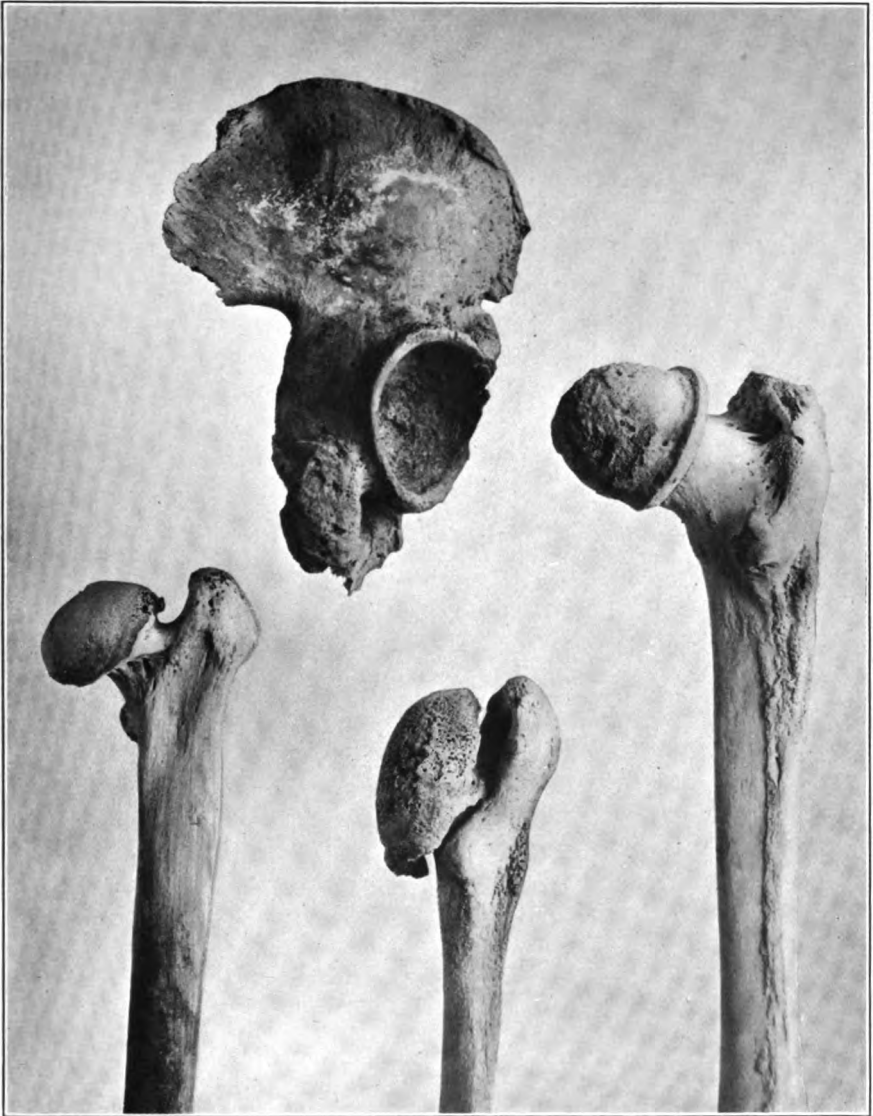
Found thus far only in adults, and especially in the aging.

Commenced in the Indian generally, first in some of the vertebræ and at the same time, or soon after, on the lower articular surface of one or both femora.

In the vertebræ the process commenced generally in the lower joints, very rarely in the upper. In the majority of instances it remained restricted to the lowest joint.

First signs: one or two "abrasion" spots on the posterior part of the surface of one or the other condyle. There may also have been early in the process slight concretory deposits on the surface of the condyles. These conditions were soon followed by a slight, uneven marginal redundancy (as if the end of the bone turned into less solid consistency and articular surface was being forced out along the margin), which gradually extended and increased until it assumed the character of a marginal, continuous, more or less irregular exostosis. As a rule it was the posterior part of one or the other





ARTHRITIS DEFORMANS OF THE HIP-JOINT AMONG THE ANCIENT PERUVIANS. PELVIC BONE AND FEMUR ON RIGHT FROM ONE SUBJECT. FEMUR ON LEFT SHOWS EARLY STAGE OF ALTERATIONS; THAT IN MIDDLE REPRESENTS A VERY ADVANCED CASE OF FLAT "MUSH-ROOM-HEAD", THAT ON RIGHT A PRONOUNCED *caput penis* CONDITION. ALL FROM THE CHIMU REGION



articular surface of the condyles that showed the first lesions. The initial lesions were gradually followed by more roughness of the articular surface, associated with an augmentation of the marginal exostosis; and then, in the case of the condyles, followed the gradual development of an abrasion-surface, grooved antero-posteriorly, with more or less wearing off of the compact layer of the bones so that some of the bone cavities beneath became visible, and with a polishing of the abraded portion.

Exostoses about the head of the femur came generally much later than those about the condylar articular surfaces, if at all.

In the tibia, changes corresponding to those in the femur developed simultaneously on and about the upper articular surface; and about the same time, or later, the process began to manifest itself also in other bones, especially the vertebræ and the humerus (lower end). Not seldom the first and occasionally the only manifestation of the disorder was manifest in the vertebræ, particularly those of the lumbar, lower dorsal and cervical regions. The material examined seemed to show plainly that the cause which gave rise to the manifestations was constitutional.

#### "TENDON LESION"

This was evidently an inflammatory lesion, of varying extent, on the posterior surface of the lower end of the femur, at and about the insertion of the medial head of the gastrocnemius.

It was quite frequent in the Chimu region on the coast, but was not noticed in the mountains, though lighter grades may have escaped attention.

Not accompanied (except accidentally) by other pathological conditions.

Present occasionally in the adolescent, but not in children.

Traumatic origin?



<i>Osteoperiostitis</i> .....	adult	1
whole shaft affected;		
bone light.		
"Mushroom head" humerus .....	adult	1
Specimens showing more than one lesion (included in the above):		
a. Head fractured and deformed, and shaft bent (not rachitic).		
b. "Mushroom" head, and moderate arthritis lower joint.		
<i>Special</i>		
Number of adult bones with aperture in septum.....	123	= 21%
Number of children bones with aperture in septum.....	4	= 7%
Total .....	127	

## RADII

Number of adult bones examined.....	255
Number of children bones examined.....	32
Total .....	287

Of these:

<i>Fractures</i> .....	adults	2
both broken just above distal end.		
<i>Dislocations</i> .....	0	
<i>Arthritis</i> .....	adults	7
3 moderate, upper joint.		
3 slight, upper joint.		
1 moderate, lower joint.		

*Special*

In two, a pair, a congenital deformation of lower articular surface.

*Combinations of lesions on same bone*..... none

## ULNÆ

Number of adult bones examined.....	301
Number of children bones examined.....	16
Total .....	317

Of these

<i>Fracture</i> .....	adults	2
1 fracture of shaft.		
1 of coronoid process.		
<i>Dislocations</i> .....	0	
<i>Arthritis</i> .....	adults	16
9 slight, upper joint.		
7 moderate, upper joint.		
<i>Combinations of lesions on same bone</i> .....	none	

## FEMORA

Number of adult bones examined.....	1,210
Number of children bones examined.....	133

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Total .....1,343

## Of these:

<i>Fractures</i> .....	0
<i>Dislocations</i> .....	adults 2 <sup>1</sup>
<i>Exostoses</i> .....	adults 4
	1 button-exostosis or osteoma.
	1 small outgrowth of bone postero-inferiorly, just below the bifurcation of the linea aspera.
	2 moderate excrescences on the great trochanter.
<i>Arthritis</i> .....	adults 36
	22 slight, lower joint.
	12 moderate, lower joint.
	1 pronounced, lower joint.
	1 slight, head as well as lower joint.
"Mushroom head" .....	adults (including 1 adolescent) 16
<i>Periostitis</i> .....	{ adults (with 1 adolescent) 9
	{ children ..... 1
	7 <sup>2</sup> slight and localized (one or more spots or patches).
	3 moderate (one or more spots or patches).
<i>Osteoperiostitis</i> .....	adults (including 1 adolescent) 6
	3 localized inflammatory enlargements.
	1 moderate, generalized.
	1 pronounced, generalized (in adolescent, bone light).
	1 exostotic, lower half of bone.
<i>Other inflammatory:</i>	
Small ulcer-like lesion on neck.....	adult 1
<i>Miscellaneous</i> .....	adults 3
	infantile paralysis..... 2
	lesion, destructive, lower two-fifths..... 1
<i>Specimens showing more than one lesion (included in the above):</i>	
a. Moderate osteoperiostitis, and slight arthritis both joints.	
b. "Mushroom" head, and destructive lesion lower two- fifths.	

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<sup>1</sup> See also under "ossa innominata."

<sup>2</sup> Including the adolescent and the child.

## TIBIÆ

Number of adult bones examined..... 781

Number of children bones examined..... 99

Total ..... 880

## Of these:

*Fractures* ..... 0

*Dislocations* ..... 0

*Exostoses* .....adults 6

1 pronounced exostosis popliteal ridge.

1 spine beneath medial condyle.

1 traumatic exostosis at middle.

1 traumatic exostosis lower third, ant. surf.

2 moderate excrescences above fibular groove.

*Arthritis* .....adults 12

8 slight superior arthritis.

4 pronounced superior arthritis (of which 1  
with abrasion-surface).

*Periostitis* ..... { adults 12  
children 1

adults 9 } slight, in patches.  
children 1 }

2 moderate, localized.

1 advanced, localized.

*Osteoperiostitis* .....adults 5

4 moderate, localized.

1 pronounced, general.

*Specimens showing more than one lesion* (included in the  
above):

a. Pronounced exostosis of popliteal ridge and moderate  
arthritis upper joint.

b. Moderate excrescences about fibular groove and slight  
arthritis upper joint.

## FIBULÆ

Number of adult bones examined..... 266

Number of children bones examined..... 24

Total ..... 290

## Of these:

*Fracture* ..... 1

*Dislocations* ..... 0

*Arthritis* .....adults 2

1 moderate, both ends.

1 moderate, lower end.

<i>Periostitis</i> .....	adults 3
1 slight, localized.	
2 moderate, localized.	
<i>Combinations of lesions on same bone</i> .....	none

## OSSA INNOMINATA

Number of adult bones examined .....	694
Number of children bones examined .....	30
Total .....	724

## Of these:

<i>Fractures</i> .....	0
<i>Dislocations of femur, unreduced</i> .....	adults 8
all early, with an irregular, shallow new joint above the cotyloid cavity.	
<i>Exostoses</i> .....	adult 1
moderate, just above acetabulum.	
<i>"Mushroom" cavity</i> .....	adults 25
10 well-marked.	
14 shallowing of cotyloid cavity and defects or lesions antero-superiorly in and above the border of the cavity.	
1 moderate, in an adolescent.	
<i>Combinations of lesions on same bone</i> .....	none

## SACRUM

Number of adult bones examined .....	199
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## Of these:

<i>Arthritis</i> .....	29
29 arthritic exostoses, upper border.	
2 of the above also joined to pelvis both sides.	
<i>Other lesions: erosion-like defects, anterior surface</i> .....	1
<i>Combinations of lesions on same bone:</i>	
2. Arthritis upper border, and of both the iliac articular surfaces.	
1. Arthritis upper border, and erosion-like defects an- terior surface.	

*Special*

*Sacral segments:* 4—0; 5—79 (58%); 6—56 (41%); 7—1 (0.7%); 63 undeterminable because of damage.



## ATLAS

Number of bones examined..... 31

Of these:

*Arthritis* ..... 1

about condylar and odontoid facets.

*Exostoses* ..... 1

a process for articulation with a paroccipital process.

*Special*

Congenital union with axis..... 1

## AXIS

Number of bones examined..... 36

Of which:

*Arthritis* ..... 3

2 about lower surface of body.

1 probably arthritic synostosis with third.

## OTHER VERTEBRÆ

Number of bones examined..... 822

Of which:

*Arthritis* (superiorly or inferiorly)..... 92mostly lumbar; synostosed: 2 lumbar; 5 lumbar  
with 6 dorsal (in one).*Other lesions*: body moderately flattened..... 1*Special*Five of the lowest lumbar, and one of the upper lumbar, show  
a separation (congenital) of the posterior part of the  
arch.

Two cervical vertebræ are congenitally joined.

## STERNA

Number of bones examined..... 26

*Pathological* ..... 0*Special*In 4 manubrium attached; in 22 manubrium separate; in  
3 the body shows an aperture in lower third.

## SCAPULÆ

Number of adult bones examined.....	229
Number of children bones examined.....	9

---

Total ..... 238

Of these:

<i>Fractures</i> .....	0
<i>Dislocations</i> .....	0
<i>Arthritis</i> .....adults	11

9 slight, glenoid cavity.

2 pronounced, glenoid cavity.

## RIBS

Number of adults (an adolescence).....	2,410
--	-------

Of these:

<i>Fractures</i> .....	14
<i>Dislocations</i> .....	0
<i>Exostoses</i> .....	1

a flat exostosis ventrally at angle.

<i>Arthritis</i> .....	36
------------------------	----

4 of articulation on head.

32 about articulation on tubercle.

<i>Periostitis</i> .....	1
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slight, external surface.

*Remarks*

First ribs show occasional arthritic conditions at sternal end.  
No case seen of ossified cartilage or of synostosis with a  
vertebra.

No ulceration.

One instance of anomalous juncture of two long ribs by a  
broad process near the spinal extremity of the bones;  
not traumatic.

## CLAVICLES

Number of adult bones examined.....	117
Number of children bones examined.....	12

---

Total ..... 129

<i>Fractures</i> .....	0
<i>Dislocations</i> .....	0
<i>Exostoses</i> .....adult	1

moderate, under surface, distal end.

<i>Arthritis</i> .....	adult	1
at sternal joint.		
<i>Periostitis</i> .....	adult	1
moderate, under surface, distal end.		
<i>Combinations of lesions on same bone</i> .....	none	

## PHALANGES

Number of bones examined (adults or adolescents)..... 213

Of which:

<i>Fracture</i> .....	1
<i>Arthritis</i> .....	3

A brief analysis of the preceding figures shows that among 3,406 long bones only 157, or 4.6 per cent, presented one or at most two pathological conditions; while among the remaining 4,777 other bones, such bones numbered 231, or slightly less than 4.9 per cent. These are exceedingly small proportions of diseased specimens, far smaller than among the modern whites of any class. The distribution of the lesions was as follows:

	Long Bones	Other Bones
<i>Fractures</i> .....	6 or one in 567 bones	15 or one in 318 bones (14 in ribs).
<i>Dislocations</i> .....	2	8 (all at hip-joint).
<i>Exostoses</i> .....	11	4
<i>Arthritis</i> .....	85 (48 at knee joint)	176 (92 in vertebræ).
"Mushroom-head" fe- mur or humerus (ar- thritis deformans)....	17 (16 femora)	25 (acetabulum).
<i>Periostitis</i> .....	24 (12 in tibia)	2
<i>Osteoperiostitis</i> .....	12	...
<i>Miscellaneous</i> .....	6	3



SMITHSONIAN MISCELLANEOUS COLLECTIONS

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# New Races of Carnivores and Baboons from Equatorial Africa and Abyssinia

BY

EDMUND HELLER

Naturalist, Smithsonian African Expedition



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# NEW RACES OF CARNIVORES AND BABOONS FROM EQUATORIAL AFRICA AND ABYSSINIA

By EDMUND HELLER

NATURALIST, SMITHSONIAN AFRICAN EXPEDITION

Further systematic study of the collection of African mammals in the U. S. National Museum has led to the discovery of the new races described in the present paper. The material was received from the Smithsonian African Expedition under the direction of Col. Theodore Roosevelt, and the Paul J. Rainey Expedition, unless otherwise noted.

## **AONYX CAPENSIS HELIOS, new subspecies**

Nyanza Clawless Otter

*Type* from the Sotik District, 40 miles southwest of Kericho Station, British East Africa; adult female, Cat. No. 175750, U. S. Nat. Mus.; collected by H. J. Allen Turner, Oct., 1912; original No. 1181.

*Characters.*—*Aonyx capensis helios* resembles *meneleki* of Abyssinia closely in coloration, having the top of the snout as far as the interorbital region and the tip of the ears white as in that species, but it differs by its much smaller body size. *Hindei* of the Tana River drainage differs by the absence of white on the top of the snout and the tips of the ears, by smaller or shorter mastoid processes and narrower or more slender zygomatic arches, but resembles it closely in body size.

*Coloration* of the body and limbs dark seal-brown, deepest on back and palest on underparts, where it is burnt umber in color. Top of head seal-brown like the body. Underfur on body pale drab-gray. The throat, sides of head to the level of the eyes and ears, lips and top of snout, patch above eye and tip of ear, silky white in striking contrast to the general dark brown color. The lips at angle of mouth and the sides of the snout are dusky brown in color.

*Measurements.*—No flesh measurements are available. The tanned skin measures in length of head and body 700 mm. and in tail 470 mm. Skull: condylo-basal length, 127; basal length, 117; zygomatic breadth, 91; mastoid breadth, 84; interorbital constriction, 30; breadth across interorbital processes, 38.5; post-orbital constrict-

tion, 27; length of palate, 57; width of narial opening, 18; width of mesopterygoid fossa at suture, 11; greatest diameter of  $M^1$ , 16.5; condylo-basal length of mandible, 85. Skull old, with the sutures all obliterated, but the teeth show well defined cusps.

*Remarks.*—The type is the only specimen in the National Museum. A female topotype of *hindei* from the Thika River, however, is in the collection also collected by H. J. Allen Turner. The skull of this specimen is practically the same age and size as the type, but differs from it by the possession of the first upper premolars, narrower narial opening, heavier zygomatic arches and longer mastoid processes. The race here described is doubtless confined to the Nile drainage and is the Uganda or Nyanza representative of the giant Abyssinian otter, *meneleki*, the largest known race. From typical *capensis* of South Africa it differs by the presence of white tips to the ears, but is otherwise quite identical to it in color and size of body, and is perhaps best considered an intermediate race between *capensis* and *meneleki*.

#### **FELIS LEO ROOSEVELTI, new subspecies**

##### Abyssinian Lion

*Type* from the highlands of Abyssinia near Addis Ababa, presented by Emperor Menelik to President Roosevelt in 1904; old male, Cat. No. 144054, U. S. Nat. Mus.; original (Nat. Zoöl. Park)

No.  $\frac{1151}{5307}$

*Characters.*—*Felis leo roosevelti* is readily distinguishable from the other described races by the greater breadth of the skull, the wider mesopterygoid fossa and the smaller size of the cheek teeth. The zygomatic arches are bowed outward to so great an extent that the outline of the skull is quite triangular. Externally this race is characterized by large body size, dark tawny coloration and heavy black tipped mane.

*Coloration.*—The dorsal coloration is tawny, lined over the middle of the back with black tipped hairs; sides of body tawny-ochraceous without, darker spots and merging gradually into the lighter ochraceous underparts. Mane heavy, extending from the forehead to behind shoulders and over the whole throat and chest areas to the forelegs and tuft on back of elbows; length of individual hairs on nape 14 inches; color effect distinct blackish, but mixed considerably by tawny hair; shoulders darkest, the hair chiefly black with short terminal tawny tips; front of mane about head and forethroat lightest,



without black, the hair uniform tawny; flanks without any evidence of a mane. Tail like the back in color, except the terminal four inches which are furnished with a heavy black tuft in which the hair is black to the roots. Outside of legs like the back in color, inside ochraceous-buff like the underparts; hair on underside of toes black in conformity with the black footpads. Head tawny black lined like the back in color, the black ear patches and the deep black eyelashes alone showing contrast; whiskers mixed black and white; ears tawny, marked on the back by a broad band of black occupying the middle half of the ear, the base and tip tawny; inner side of ears ochraceous.

*Measurements.*—Measurements of tanned skin: head and body, 1,780 mm.; tail, 760; hindfoot (bone still in place), 350. Skull old, the sphenoidal and occipital sutures anchylosed and the sagittal and lambdoidal crests well developed. Greatest length from occipital crest to tip of premaxillæ, 333 mm.; condylo-basal length, 297; zygomatic breadth, 255; interorbital constriction, 69; post-orbital constriction, 60; width across post-orbital processes, 104; nasals, 92 x 62; upper cheek teeth series, 73; length of upper carnassial, 35; width of mesopterygoid fossa at suture, 45; distance between bullæ across basi-occipital, 26; condylo-basal length of mandible, 230.

*Remarks.*—The type was received alive March 19, 1904, and deposited in the National Zoölogical Park at Washington where it lived until November 14, 1906. Owing to its short stay in captivity it may be taken as a normal specimen of the lion inhabiting the Abyssinian highlands. Neither the hair covering nor the condition of the skull shows any abnormalities due to its life in the Zoölogical Park. Judging by its skull it was an old animal well along in middle life at its death, and was doubtless fully adult when captured by the Abyssinians. Another adult male specimen from Abyssinia, also from the National Zoölogical Park, is in the National Museum. This specimen agrees with the type in the broad character of the skull and small size of the teeth. A specimen received from the Sudan, sent by the Sirdar, Sir Reginald Wingate, to the National Zoölogical Park, is also a member of this race. The skull of this specimen is even wider than in the type and exceeds in this dimension the record lion skull from Delago Bay, South Africa, now in the Berlin Museum. The two Abyssinian and the Sudan skulls are easily distinguishable by their great width, wide mesopterygoid fossa and small cheek teeth, from a series of 30 male skulls of *massaica* of equal age in the National Museum from British East Africa, shot by Colonel and Kermit Roosevelt, Paul J. Rainey, John Jay White, and Dr. W. L.

Abbott. Specimens have also been examined at the British and Berlin museums from south and west Africa. The west African skulls are easily distinguishable from east or south African specimens by their small size, great breadth and large carnassial or cheek teeth. The Abyssinian lion approaches this western type in the breadth of skull, but the teeth are of the small eastern type, and the large skull also distinctive of the east coast lions. Distinctly the largest of all is the South African lion, now quite extinct. The skull averaged at least an inch longer in length than any of the equatorial races, but was relatively quite narrow. In coloration the Cape race resembled the Abyssinian, being tawny bodied with a black mane. The Somali lion, the nearest geographical ally of the Abyssinian, is a light-buffy colored desert race, closely resembling and doubtfully distinct from the Masai lion. It is much shorter maned and smaller in body size than the Abyssinian. The characters assigned by Noack in the original description of *Felis leo somaliensis* of larger ears and longer tail are not applicable to the race, these parts having the same proportionate size as in other members of the group. Noack's description was based on a pair living at the Berlin Zoölogical Gardens, and the characters he assigned to the race, are merely such as appeared upon casual observation and are not founded upon actual measurements of a specimen. Doctor Matschie has informed me that the types have been exchanged by the Berlin Zoölogical Gardens with animal traders and their present abode is unknown. The unfortunate condition of these types is a good illustration of the loss and confusion to systematic work so often attendant upon the pernicious custom of naming species from living specimens. In the present case we have no exact characters and no knowledge of the skull structure of the race described, merely a few casual observations to which are attached a general locality of doubtful value. Several of the types of African big game mammals are to-day living in various zoölogical gardens. Special efforts should be made by such institutions to keep trace of these types and upon their death deposit the specimens in the largest available public museum where they may be preserved and accessible to zoölogists for comparison.

**FELIS LEO NYANZÆ, new subspecies**

Uganda Lion

*Type*, a flat skin, from Kampala, Uganda, gift of the European residents to Colonel Roosevelt; adult male, Cat. No. 164551, U. S. Nat. Mus.; received Dec. 30, 1909; original (Heller) No. 580.

*Characters.*—*Felis leo nyanzæ* differs from *massaica* of British East Africa by its darker tawny coloration and short mane. In coloration it closely resembles the Abyssinian lion, but lacks the heavy black mane of that species and the large body size. The skull is smaller and narrower than *massaica*, but resembles it in the relative size of the cheek teeth and mesopterygoid fossa.

*Coloration.*—Dorsal coloration ochraceous-tawny vermiculated slightly with black on median line; sides ochraceous without darker spots; belly buffy-ochraceous. Mane short, not extending on shoulders except on median dorsal line where it forms a narrow ridge of hair 2 inches wide by 10 inches long; length of hair on middle of neck only 3 inches; color tawny throughout, only showing dark brownish color at tips of hair on crown and shoulders. Limbs like the back in color, the thighs posteriorly with a blackish stripe; under-side of toes seal-brown. Head tawny like back. Ears chiefly tawny, the black area being reduced to a narrow line.

*Measurements.*—Measurements of the flat skin: head and body, 1,990 mm.; tail, 890; ear, 100. Skull missing, only the premaxillaries, canine and incisor teeth and nasal bones preserved with the skin. These indicate a fully adult animal. An adult male specimen in the British Museum from Mulema, Uganda, collected by Colonel Delme-Radcliffe is quite identical with the type in color and may be taken as representing the race here described. This specimen has a narrow, short skull with rather small teeth. The dimensions are: greatest length, 363 mm.; condylo-incisive length, 324; zygomatic width, 230; interorbital width, 74; post-orbital constriction, 66; width across post-orbital processes, 111; length of upper carnassial tooth, 37; nasals, 116 x 69; condylo-basal length of mandible, 237.

*Remarks.*—The Uganda race of the lion does not apparently share the close approximation to its west African representative that is exhibited by much of the mammal fauna of the region. The broad skulled, large-tooth form of west Africa is strikingly different from the narrow skulled, small-tooth *nyanzæ* which is a close ally of *massaica*.

#### **FELIS PARDUS FORTIS, new subspecies**

##### Highland Leopard

*Type* from the Loita Plains, Southern Guaso Nyiro district, British East Africa; adult male, Cat. No. 181600, U. S. Nat. Mus.; collected by Mr. Aggate in the bush country bordering his farm, and purchased by Paul J. Rainey, May 31, 1911; original (Heller) No. 2309.

*Characters.*—*Felis pardus fortis* is a large race which attains the maximum size, the skull exceeding in length that of any other African or Asiatic race. The skull is further distinguishable by its narrowness, the small size of the tympanic bullæ and the absence of the first upper premolar. Body size large, with long pelage, dark coloration, and numerous small rosetted spots, the central color of which it not differentiated in shade from the general ground color. *Fortis* in color most resembles *suahilica*, but is easily distinguishable by the darker ground color which is uniform in shade with the central portion of the rosetted spots. Male skulls of *suahilica* differ in their much smaller size, the largest being seven-eighths of an inch less in length than the type of *fortis*, decidedly larger bullæ, and presence of a well developed first upper premolar. The bullæ in *fortis* do not rise to the level of the mastoid process, the skull when placed on a level resting upon the bullæ, but in *suahilica* they extend well beyond the mastoid.

*Coloration of the type.*—Ground color on median line of back cinnamon-brown, paling on sides to ochraceous-tawny, and on underparts and inside of limbs to whitish or pale buff. The rosetted spots on the back are small and broken into two or three sections, the central portion being uniform in color with the cinnamon-brown ground color; on the sides of the body the central portion is darker than the ground color as usual among leopards. The underparts, legs, head, and basal part of tail are marked by solid black spots. The terminal portion of the tail is solid blackish with a narrow median whitish band on the underside. Ears tawny like the ground color of the head and marked by a broad band of black across the middle of the back.

*Measurements.*—The type is without flesh measurements. The skull measures: greatest length, 260 mm.; condylo-basal length, 236; zygomatic width, 157; interorbital width, 43; width across post-orbital processes, 75; post-orbital constriction, 37; nasals, 75 x 39; length of upper carnassial, 27; width of mesopterygoid fossa at suture, 20; condylo-basal length of mandible, 172. Skull old, the sphenoidal and interparietal sutures fully anchylosed. The type is unique in skull characters and large size among a series of 25 leopards from east equatorial Africa in the National Museum.

**FELIS PARDUS CHUI, new subspecies**

Nile Leopard

*Type* from Gondokoro, Northern Uganda; adult male, Cat. No. 164764, U. S. Nat. Mus.; collected by Edmund Heller, Feb. 26, 1910; original No. 653.

*Characters.*—*Felis pardus chui* is characterized by its widely isolated spots, which are few in number and separated from one another by wide interspaces of the ground color. From the leopard of British East Africa, *suahilica*, it is distinguishable by the wide interspaces between the spots, the white ground color of the upper surface of the hindfeet, the more extensive white surface to the underside of the tail and the larger body size and skull. The west African leopard, *leopardus*, has actually and relatively much larger cheek teeth, more numerous spots and smaller body size than *chui*. Pelage very short.

*Coloration.*—The dorsal body color is ochraceous, paling on the sides to buffy, and on the belly and underside of legs to pure white. Spots black, rosetted, the center usually darker ochraceous than the ground color, the margin in some forming a complete ring without any breaks, and distinctly ocellated in character. Spots on underside of body and on legs generally solid black without a lighter central portion. Spots on head and sides of face broken up into numerous small blotches. The tail basally with rosetted spots which become lengthened into solid streaks on the middle portion, the terminal portion having a ringed appearance with much white from the underside showing on the sides and nearly separating the black into rings.

*Measurements.*—Measurements of the type in the flesh: head and body, 1,240 mm.; tail, 840; hindfoot, 255; ear, 90. Skull: greatest length, 243; condylo-basal length, 225; zygomatic breadth, 150; inter-orbital constriction, 37; width across post-orbital processes, 64; post-orbital constriction, 38; nasals, 77 x 35; length of upper carnassial, 24.5; width of mesopterygoid fossa at suture, 26. Skull old, the sphenoidal and interparietal sutures fully anchylosed. First upper premolar minute and rudimentary.

*Remarks.*—Another specimen, an adult male from Rhino Camp, Lado Enclave, is in the National Museum which agrees in color characters and large size of skull with the type. *Chui* is a lowland race occupying the Nile Valley, and characterized by the reduced number of spots, some of which are ocellated, large body size and short pelage. A large series of *suahilica* from British East Africa have been compared with the two Nile specimens representing this race and in this series the color differences are well marked and constant.

**ACINONYX JUBATUS VÉLOX, new subspecies**

African Highland Cheetah

*Type* from the Loita Plains, British East Africa; adult male, Cat. No. 163096, U. S. Nat. Mus.; shot by Kermit Roosevelt, June 12, 1909; original (Heller) No. 107.

*Characters.*—The African highland cheetah, *Acinonyx jubatus velox*, is characterized by its large, close set black spots which predominate over the ochraceous tone of the ground color, the boldly spotted hind legs, long pelage, and large body size. From *jubatus* of the Cape region of Africa it may be recognized by its larger dorsal spots, lighter ground color and larger body size. It may be distinguished from *raineyi* by the absence of pinkish suffusion to the coat, the larger and more numerous spots, and longer pelage.

*Coloration.*—The dorsal ground color of the type is ochraceous, deepest on midline of back and palest on sides and belly, where it shades into cream-buff. Black spots on back circular in outline, three-quarters of an inch in diameter, interspaced with numerous smaller black spots causing the black color to predominate over the ground color on the back. The spots on the sides are larger but less numerous and cover a smaller area than the ground color. The legs and underparts are marked by oblong black spots. The feet are marked by irregular black spots, the forefeet more numerous than the hind ones, and the base of the toes also show spots above, but the hair on the underside is dusky-brown. Tail marked by large black spots above and black rings below, with the terminal portion ringed all around with black and pale buffy rings, the tip whitish. The crown of the head and the nape are marked by small black spots as far forward as the interorbital region. The whole snout from the eyes is uniform ochraceous and banded on the sides by the heavy black tear band from the eyes to the mouth. The sides of the head from eye to ear base are marked irregularly by small black spots without any suggestion of a line from eye to base of ear. The chin and the upper throat are whitish or cream-buff in color. The back of the ears are chiefly black, only the tips and the inner side being buffy. Hair of nape longer than on rest of body and forming a short mane from head to behind the shoulders. Hair on median line of breast and belly long and mane-like in character. The ventral surface of the tail is marked along its whole length by a broad mane or ruff of longer hair, tip of tail long haired, and somewhat tuft like.

*Measurements.*—The flesh measurements of the type are: head and body, 1,300 mm.; tail, 740; hindfoot, 300; ear, 80. Skull: greatest length, 179; condylo-basal length, 163; zygomatic breadth, 136; nasals, 56 x 31; interorbital width, 40; post-orbital constriction, 59; width across post-orbital processes, 82; length of upper carnassial, 23; width of mesopterygoid fossa at suture, 25.5; condylo-basal length of mandible, 124. Skull aged, the sphenoidal and occipital sutures obliterated by anchyloses.

*Remarks.*—Twelve adult specimens of this race are in the National Museum, nine from the Loita Plains, two from Laikipia Plateau north of Mount Kenia and one from the Uasin Gishu Plateau. The latter specimen has an extremely long skull measuring in greatest length 200 mm., and exceeding in size any other cheetah skull examined. One other male skull from the Loita Plains attains a length of 190 mm. These dimensions would indicate that the British East African or highland cheetah is the largest of the races. The series is quite uniform in coloration and distinguishable from *raineyi* by the darker color and more numerous spots on the back which predominate in area and give the whole a general dark coloration.

**ACINONYX JUBATUS RAINEYI, new subspecies**

Rainey African Cheetah

*Type* from Ulu, Kapiti Plains, British East Africa; adult male, Cat. No. 182321, U. S. Nat. Mus.; shot by Paul J. Rainey, Oct. 13, 1911; original (Heller) No. 2639.

*Characters.*—*Acinonyx jubatus raineyi* is a pale colored, short haired race of the African cheetah having a light pinkish-buff dorsal ground color and large blackish spots. It resembles most closely in characters *soemmeringii* of Kordofan and the Lake Tchad region, but may be distinguished by its much larger dorsal spots, lighter ground color and the spotted hindfeet. From its nearest geographical ally, *velox*, it may be distinguished by the light dorsal ground color with its pinkish suffusion, fewer dark spots and less distinctly spotted hindfeet.

*Coloration of the type.*—The ground color is pale pinkish-buff, darkest on midline, where it is ochraceous-buff, and paling on the underparts to cream color. Body and legs marked uniformly by round black spots three-quarters of an inch in diameter, interspersed by occasional small spots or dots. Spots on legs and belly elongate in shape; legs spotted to the toes, the forefeet much more conspicuously than the hind ones in which the spots are small or indistinct near the toes. The toes are much spotted above and pinkish-buff like the ground color, but below they are clothed by dusky-drab hair. Tail spotted like the back with the terminal one-fourth marked by five black rings, the extreme tip whitish. Top of head and nape marked by numerous small black spots, but the snout is uniform ochraceous-buff without spots and sharply defined on the sides by a black tear stripe extending from the eye to the mouth, just behind whiskers, and passing backward to the angle of the mouth. The sides of the

head behind the eye and below the ear are marked by a few black spots, but no evident line between the eye and the base of ear is thus formed. The ears are pinkish-buff marked by a wide black band covering lower half of back. The chin and upper throat are white. Pelage short on dorsal surface, seven-eighths of an inch on the rump; nape with a short mane three inches wide from head to behind shoulders. The midline of breast and belly and the whole length of the ventral surface of the tail is furnished by a ruff or short mane of longer fluffy hair.

*Measurements.*—No flesh measurements of the type are available. The skull measures: greatest length, 180 mm.; condylo-basal length, 162; zygomatic breadth, 122; nasals, 55 x 31; interorbital width, 39; post-orbital constriction, 53.5; breadth across post-orbital processes, 72.5; length of upper carnasial, 22; width of mesopterygoid fossa at suture, 25; condylo-basal length of mandible, 122. Skull, young adult, the sphenoidal and parietal sutures still evident.

There are six specimens of this race in the National Museum collection, four of which are adult females and two adult males. Five of the specimens are from the Kapiti Plains near Ulu station, and one from Juja Farm. This series shows little variation in color, all being quite light colored with a distinct pinkish suffusion to the buff ground color. They differ from *velox* of the higher plateau region by the lighter ground color which predominates over the black of the spots which are in this race more widely separated. *Raineyi* represents the coast race of the cheetah which inhabits the lower slopes of the plateau region and the edge of the coast desert region about the slopes of Kilimanjaro and in the vicinity of the Tana River. The Athi and Kapiti Plains are the farthest inland point reached by this race.

#### **PAPIO ANUBIS LESTES, new subspecies**

##### **Athi Baboon**

*Type* from the Ulukenia Hills, Athi Plains, British East Africa; adult male, Cat. No. 164633, U. S. Nat. Mus.; collected by J. Alden Loring, Nov. 19, 1909; original No. 8234.

*Characters.*—*Papio anubis lestes* differs from *furax* of the Rift Valley region by the much narrower and longer rostral portion of the skull, longer tooth row, less blackish feet, shorter tail and smaller body size. From *vigilis* it may be distinguished by its darker body color, presence of black on the hands, and smaller body size.



*Coloration.*—General color of the type olive; hair annulated, basally hair brown with a broad subterminal band of buffy and a black tip. Skin of face quite blackish with a scattered growth of downy grayish hair. Forefeet showing a mixture of black and olive; hindfeet without blackish cast, being vermiculated like the body. Chin and throat blackish, rest of underparts vermiculated like the upperparts, but the hair of the chest and belly basally seal-brown or black.

*Measurements.*—Measurements in the flesh: head and body, 723 mm.; tail, 439; hindfoot, 215. Skull old, with the incisors much worn. Greatest length, 198; basilar length, 135; zygomatic breadth, 115; rostral width midway between orbit and nares, 30; length of snout from orbit to tip of premaxillæ, 110; length of upper cheek teeth series, 55. The snout in *furax* is equal in length to that of *lestes*, but it is fully a third wider measuring usually more than 40 mm.

*Remarks.*—Three old males of this race are in the National Museum collection from the Ulukenia Hills. They agree in having the rostrum long and narrow as in the type and are easily distinguishable by this character from skulls of *furax*. The race described as *neumanni* from the Rift Valley of German East Africa is decidedly smaller and lighter colored.

**PAPIO ANUBIS VIGILIS, new subspecies**

North Kenia Baboon

*Type* from the Lakiundu River near its junction with the Northern Guaso Nyiro, British East Africa; old male, Cat. No. 182033, U. S. Nat. Mus.; collected by Edmund Heller, July 10, 1911; original No. 2337.

*Characters.*—*Papio anubis vigilis* is a very long, slender snouted race of large body size. The snout has the same proportions as *lestes*, but the body size is much larger, the general coloration paler, the face grayish rather than blackish, the tail longer and the forefeet or hands without any blackish coloration. From *furax* it differs by its more slender and longer snout, lighter coloration and absence of black on the hands.

*Coloration.*—General color of the type light grayish olive on the shoulders, the back and rump buffy brown lightly vermiculated by black. Forelimbs like the shoulders to the finger tips, the hands not differentiated by darker color. Hindlimbs more buffy like the rump in color, but without black vermiculation, the feet uniform in color with the rest of the limb. Tail like the hindlimbs, the terminal por-

tion lighter and grayer. Skin of face mouse-gray with a downy growth of short grayish hair. Whiskers and hair on lips blackish.

*Measurements.*—Measurements in the flesh: head and body, 700 mm.; tail, 540; hindfoot, 190; ear, 50. Skull very old, the canines worn down level with the premolars and the molars worn down level with the gums. Greatest length, 212; basilar length, 151; zygomatic breadth, 125; width of rostrum midway between orbit and nares, 44; length of rostrum from orbit, 118; length of upper cheek teeth series, 52.

*Remarks.*—There is besides the type another adult male from the Northern Guaso Nyiro which agrees in length and slenderness of rostrum with the type. These two specimens are readily distinguishable by the rostral characters from a series of *furax* and *lestes* in the National Museum.





SMITHSONIAN MISCELLANEOUS COLLECTIONS  
VOLUME 63, NUMBER 8

EXPLORATIONS AND FIELD-WORK OF THE  
SMITHSONIAN INSTITUTION  
IN 1913



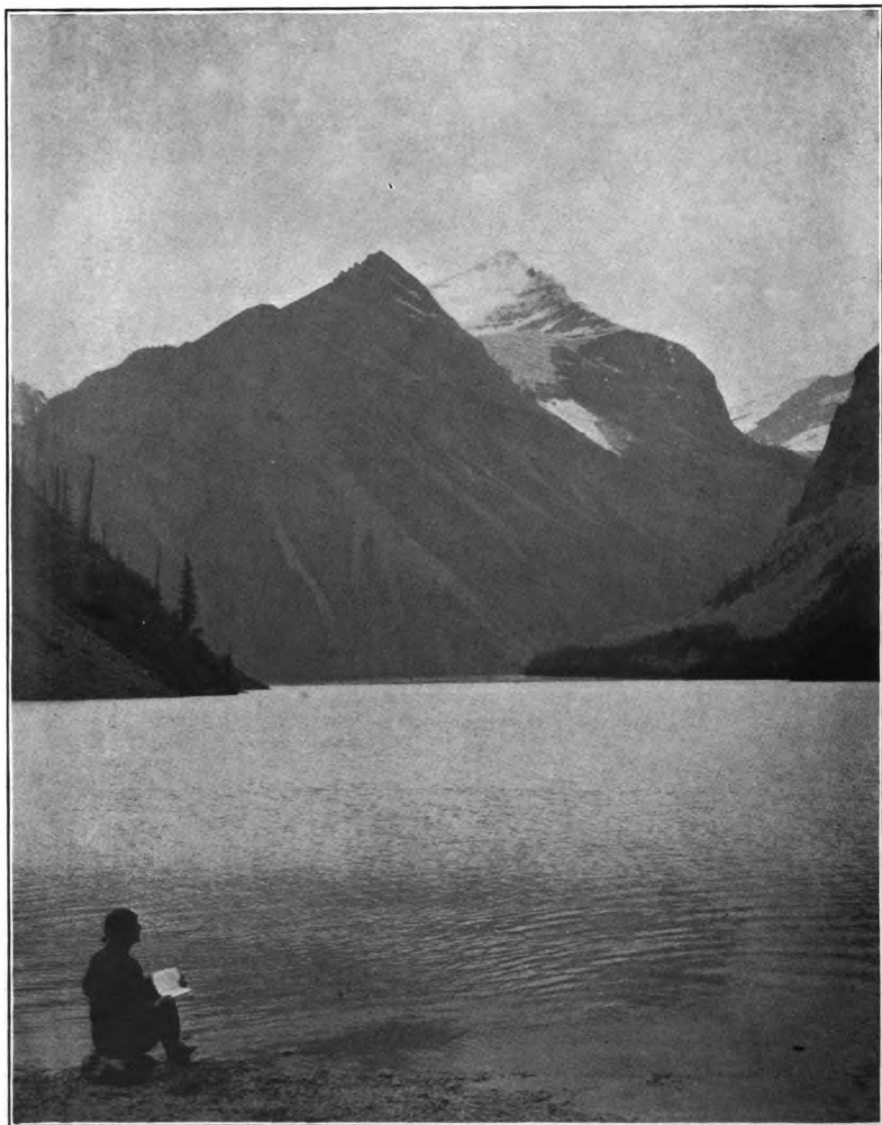
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Looking north from foot of Kinney Lake toward Whitehorn Peak. On the right the cliff at the foot of Robson Peak. Miss Helen B. Walcott on beach in foreground. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.



## EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1913

### INTRODUCTION

There is here presented a general account of the exploration and field-work conducted by the Smithsonian Institution and its several branches, including the United States National Museum, in various parts of the world during the calendar year 1913. These explorations were made by means of allotments from the Smithsonian funds, from Congressional appropriations, and through the coöperation of other institutions and of individuals engaged or interested in geological, biological, or anthropological investigations.

The Institution and its branches were thus represented in a large number of field parties whose researches have tended to increase the general knowledge in various subjects, and have added much valuable material to the collections of the National Museum. Owing to its limited funds, the Institution was unable to participate in several additional enterprises in which opportunities for representation were offered.

In the preparation of the present account the direct statements of those who participated in the field-work have been employed, with one or two exceptions, while nearly all the photographs were made by the explorers themselves.

Some of the work carried on in 1913 was in continuation of operations begun in previous years and reported in part in accounts heretofore published by the Institution.<sup>1</sup>

Three Government branches of the Institution are represented in this report: The National Museum, although having no specific funds for exploration work, avails itself as far as possible of all opportunities presented for making collections in the field; the Bureau of American Ethnology engages largely in field-work, which is covered in detail in the annual report of that bureau; and the

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<sup>1</sup> Expeditions Organized or Participated in by the Smithsonian Institution in 1910 and 1911. Smithsonian Misc. Coll., Vol. 59, No. 11, 1912.

Explorations and Field-Work of the Smithsonian Institution in 1912. Smithsonian Misc. Coll., Vol. 60, No. 30, 1913.

Astrophysical Observatory at times conducts special expeditions both in the United States and abroad, in connection with its regular work of studying the physical properties of the sun and their effect on the earth.

Both the National Museum and the National Zoological Park received during the year many donations and accessions presented or collected by collaborators in this country and abroad who have no official connection with either branch. The remaining branches under the Smithsonian Institution were not represented by any field parties, and therefore are not mentioned in this account.



FIG. 1.—Looking northeast toward the top of Robson Peak from Rainbow Brook, one-quarter mile south of Lake Kinney, Robson Park, British Columbia, Canada. Photograph taken while clouds and mist were drifting over the upper part of the peak. The summit of the peak is 8,800 feet above the camera. The view shows the southwest face of the peak. Photograph by C. D. Walcott, 1913.

#### GEOLOGICAL EXPLORATIONS IN THE CANADIAN ROCKIES

In continuation of his previous geological researches in the Canadian Rockies, Dr. Charles D. Walcott, Secretary of the Institution, revisited during the field season of 1913, the Robson Peak district in British Columbia and Alberta, and the region about Field, British Columbia. At the latter place he received the members of the International Geological Congress.

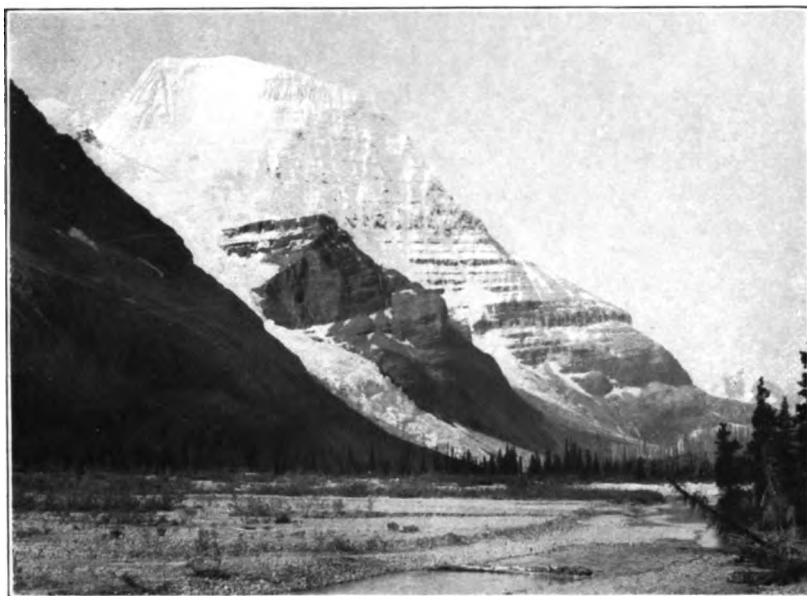


FIG. 2.—Robson Peak from a ridge above and north of east end of Berg Lake, showing north side of peak. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.

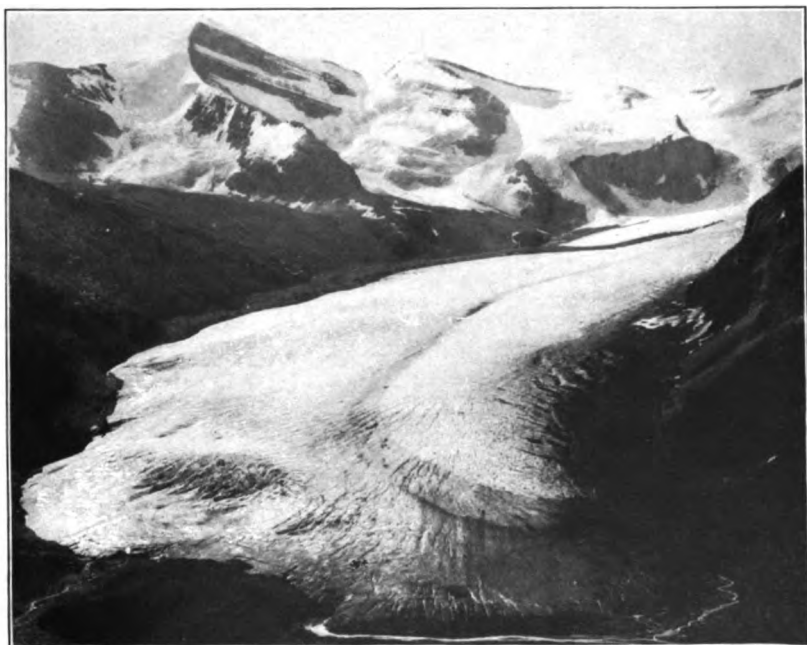


FIG. 3.—Hunga Glacier from south slope of Mumm Peak, with Phillips and other mountains to the south. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.

On this trip to Robson Peak, Dr. Walcott approached from the west side, in order to study the local geological section which he considers one of the finest in the world. From the west foot of Robson Peak, Whitehorn Peak rises on the north to a height of 7,850 feet above Lake Kinney (frontispiece), and on the east the cliffs of Robson rise tier above tier from the surface of the lake to the summit of the peak, a vertical distance of 9,800 feet. The base of this geo-



FIG. 4.—Phillips Mountain, from Robson Pass, looking over the front of Hunga Glacier. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.

logical section is shown on the right of the frontispiece, and the upper half by figure 1, while figure 2 illustrates a profile of 7,500 feet of the section.

From beneath the base of the mountain at Lake Kinney, the strata slope gently upward so that more than 4,000 feet in thickness of beds, which pass under Robson Peak, are exposed in ledges to the north and south. A considerable portion of this thickness is shown in the dark peak to the left of Whitehorn Peak in the frontispiece.

Owing to exceptionally good climatic conditions, the season of 1913 proved unusually favorable for viewing Robson Peak. Fre-

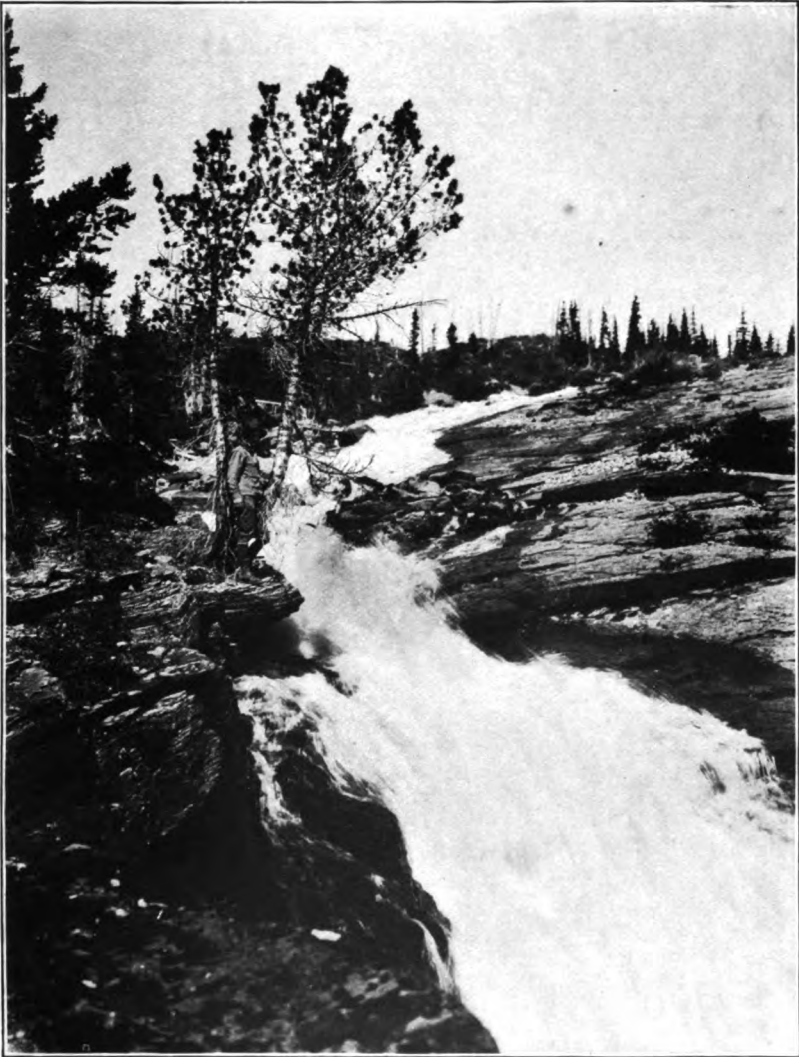


FIG. 5.—Brook entering Berg Lake, one mile southwest of Robson Pass. View taken about half a mile from the lake. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.

quently in the early morning the details of the snow slopes on the summit of the peak were beautifully outlined. Toward evening,

however, the mists driven in from the warm currents of the Pacific, 300 miles away, shrouded the mountain from view (fig. 7).

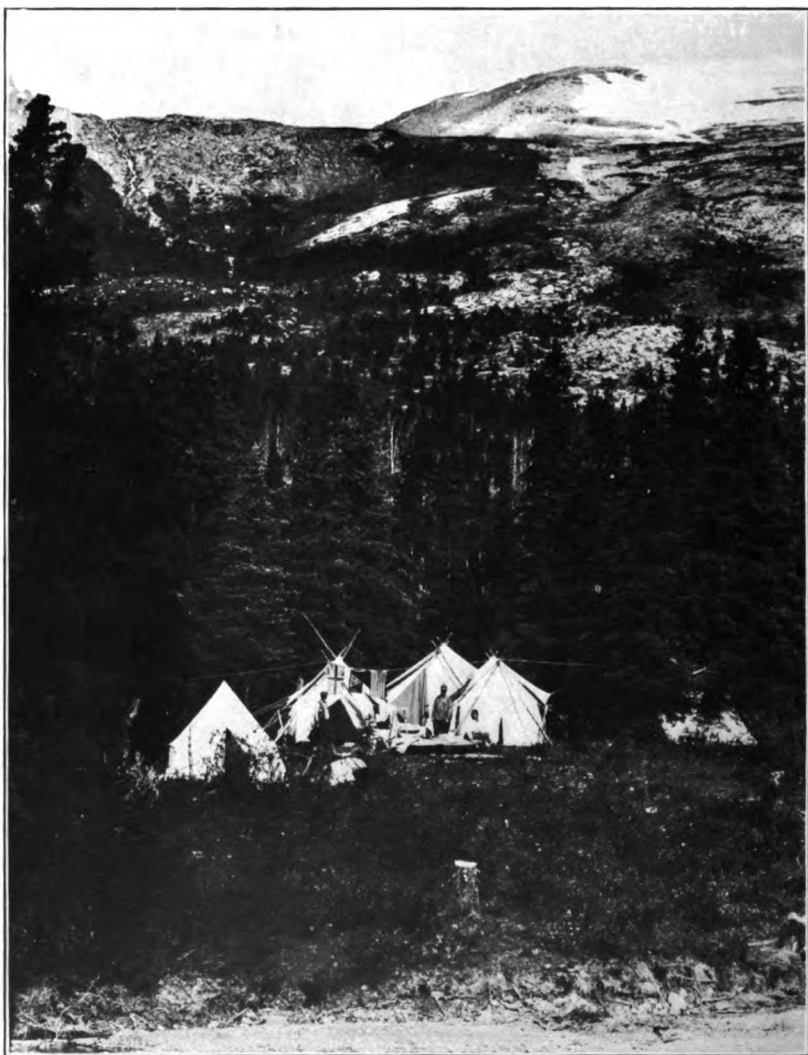


FIG. 6.—Camp on the north side of Robson Pass.  
Photograph by C. D. Walcott, 1913.

From the slopes of Titkana Peak, west of the great Hunga Glacier (figs. 3 and 4), a wonderful view is obtained of the snow fields and falling glaciers east of Robson Peak. The glacial streams come



FIG. 7.—View from Walcott Camp, looking westward over President Range after sunset when the mist is driving eastward over the mountains. Near Field, British Columbia, Canada. Photograph by C. D. Walcott, 1913.



FIG. 8.—Panoramic view of west side of foot of Hunga Glacier where the stream forming the head-waters of Grand Fork comes from beneath the ice and flows westward into Berg Lake. Robson Park, British Columbia, Canada. Photograph by C. D. Walcott, 1913.



FIG. 9.—View looking out from the fossil quarry over Burgess Pass, to the right of the mountain, the Van Horne Range in the distance, the President Range and Emerald Lake. On the left the Kicking Horse Valley, Mount Dennis, and in the distance Mount Vaux. Near Field, British Columbia, Canada. Photograph by C. D. Walcott, 1913.



FIG. 10.—North end of the fossil quarry above Burgess Pass on the slope of the ridge between Mount Wapta and Mount Field, 4,000 feet above Field, British Columbia, Canada. Photograph by C. D. Walcott, 1913.



tumbling down the slopes (fig. 5) and often disappear beneath the glacier to reappear at its foot with the volume of a river (fig. 8).

At Field, British Columbia, work was continued at the great Cambrian fossil quarry, where a large collection of specimens was secured. The conditions were such that it was necessary to do much heavy blasting to reach the finest fossils which occur in the lower layers of rock. Figure 10 shows the north end of the quarry below the sharp



FIG. 11.—South end of fossil quarry, where many of the most beautiful specimens were secured from the lower three feet of beds. Near Field, British Columbia, Canada. Photograph by C. D. Walcott, 1913.

summit of Mount Wapta, and, in the distance, the President Range with Emerald Lake at its base. The south end of the quarry is illustrated by figure 11; here the solid beds were blasted out to a depth of 22 feet.

Owing to the presence of a fault line, just north of the quarry, and the twist and compression of the rocks south of it, the available area for successful collecting is limited to about 200 feet. In other localities where the shale outcrops on the ridges in the vicinity, com-

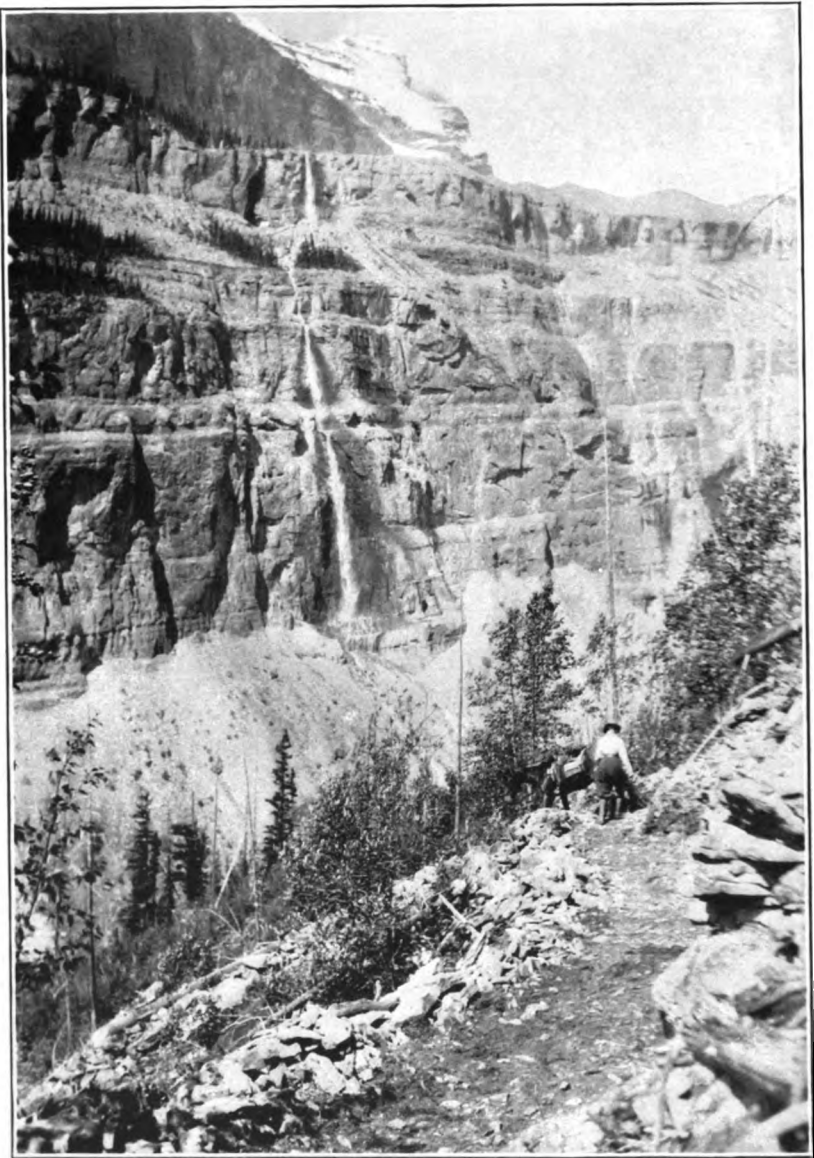


FIG. 12.—View of the west cliff of the valley of the Thousand Falls. On the trail from Lake Kinney to Berg Lake. Photograph by R. C. W. Lett, Grand Trunk Pacific Railway, 1913.

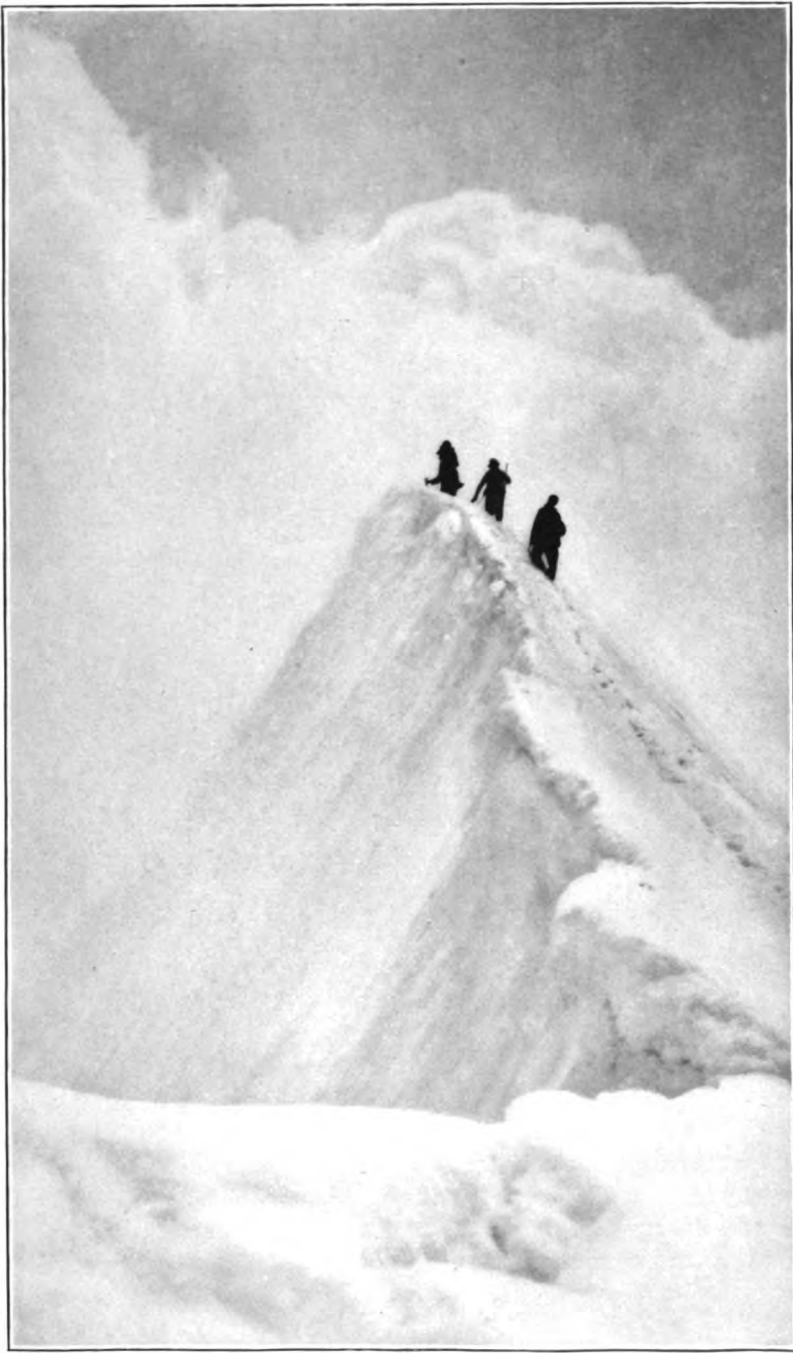


FIG. 13.—Summit of Mount Resplendent, with the mist driving over the three members of the Alpine Club of Canada. Photograph by P. L. Tait, British Columbia, 1913.

pression and shearing have so changed the character of the rock that it is impossible to obtain fossils in a condition to be of service.

The collections of 1913 contain a number of very important additions to this ancient Cambrian fauna, and many fine additional examples of species found in 1912.

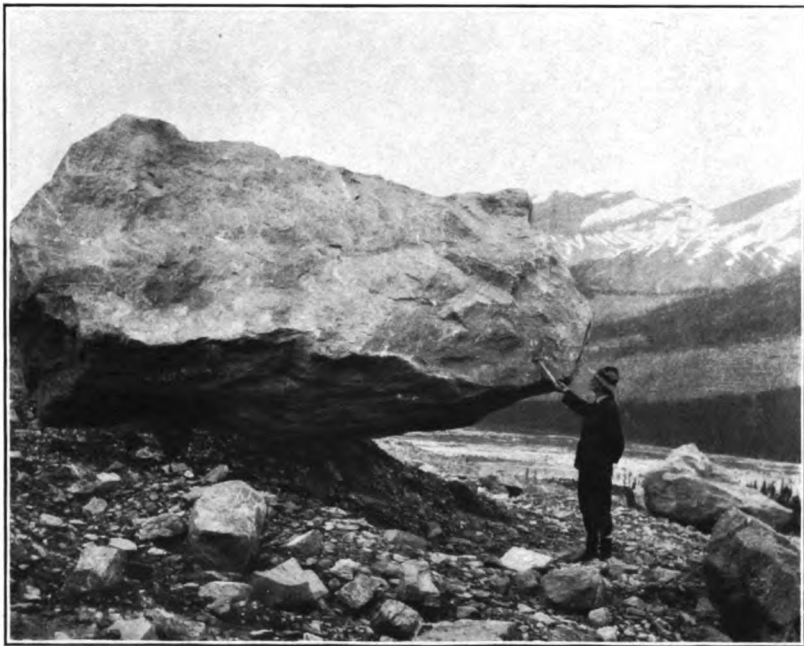


FIG 14.—Boulder train on the surface of the west side of Hunga Glacier, overlooking the Robson Pass, British Columbia. The Secretary of the Smithsonian Institution is standing beside the boulder. Photograph by Miss Helen B. Walcott, 1913.

#### GEOLOGIC HISTORY OF THE APPALACHIAN VALLEY IN MARYLAND

Dr. R. S. Bassler, curator of paleontology in the U. S. National Museum, spent a month during the summer of 1913, in the Appalachian Valley of Maryland and the adjoining States, studying the Postpaleozoic geologic history of the region, as indicated by the present surface features. His studies, which were under the joint auspices of the U. S. National Museum and the Maryland Geological Survey, were in continuation of work carried on during the previous summer when the sedimentary rocks of the region were mapped in detail, the final object being the preparation of a report on the Lower

Paleozoic strata of Maryland, to complete a series of memoirs published by that State. Owing to the brevity of this account, only a few points in the physiographic history will be noted here.

Since Carboniferous time western Maryland has been above the sea, and its rocks have accordingly been subjected to a long period of aerial erosion. During Jurassic time, the area remained stationary for so long a period that the surface of the land in the Appalachian province was reduced to a rolling plain. Later uplift raised this

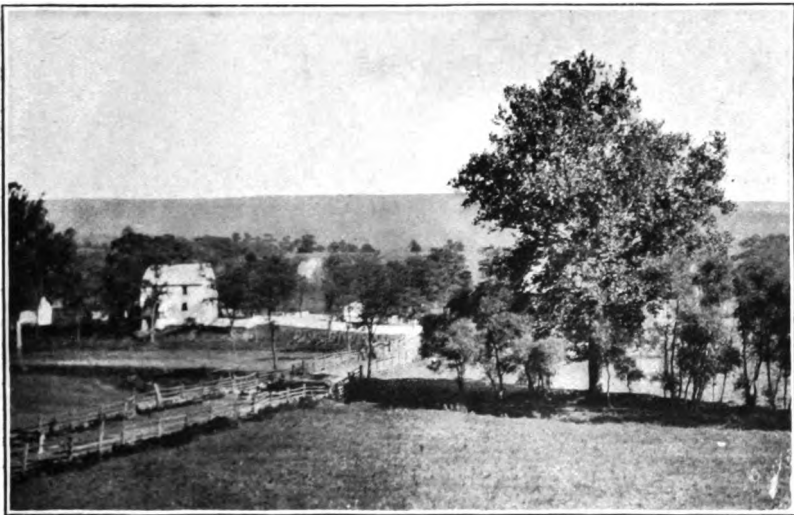


FIG. 15.—Jurassic (Schooley) peneplain, preserved in the Blue Ridge of Maryland. Photograph by Bassler.

plain still higher above sea level, and in Maryland only remnants of the old surface are preserved in the flat skyline of the highest mountains. This ancient plain, or Schooley peneplain, as it is termed, is well preserved on the top of the Blue Ridge, as shown in figure 15.

A second great period of erosion occurred in early Tertiary time, the effects of which were chiefly in the Appalachian Valley proper, where the erosion is indicated by a pronounced plain at an elevation of about 750 feet. This plain was formed only on the softer Paleozoic rocks, and, because of its prominence near Harrisburg, Pennsylvania, is known as the Harrisburg peneplain. Conococheague Creek traverses the Harrisburg peneplain in Maryland, and has dissected it

considerably, as shown in figure 16, but the even skyline of the ancient plain is still clearly evident.

Other factors in the geologic history of Maryland are recorded in the well defined gravel terraces along the major streams of the area and in great alluvial fans of large and small bowlders, spreading out at the foot of the larger mountains and sometimes reaching a depth of 150 feet. All of these phenomena have been plotted and will form a part of the geologic map of the region.

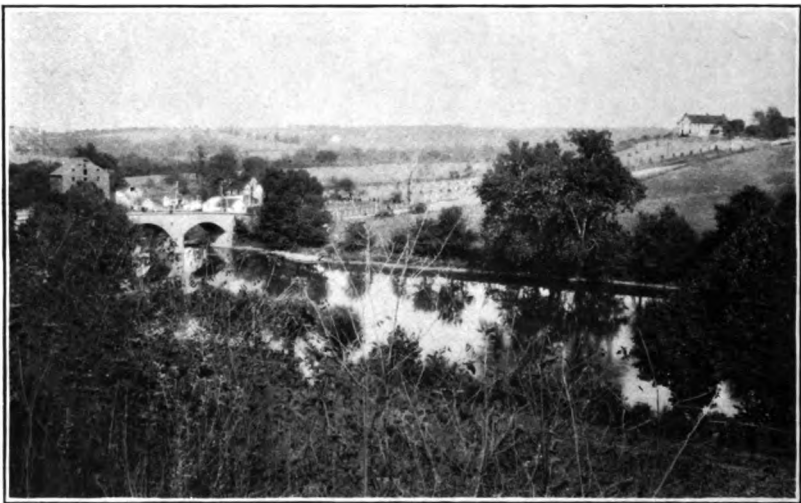


FIG. 16.—Dissected Early Tertiary (Harrisburg) peneplain, west of Hagerstown, Maryland. Photograph by Bassler.

#### COLLECTING FOSSIL ECHINODERMS IN ILLINOIS

The special field explorations maintained by Mr. Frank Springer, associate in paleontology in the U. S. National Museum, were continued during the season of 1913 by his private collector, Frederick Braun. The purpose of these explorations is to obtain additional material for use in Mr. Springer's monographs upon the fossil crinoidea, now in course of preparation, but they also result in important accessions of excellent specimens for the completion of the exhibition series in the hall of Invertebrate Paleontology in the National Museum.

The investigations of the past summer were confined to the Kaskaskia rocks of Monroe and Randolph Counties, Illinois. They were systematically carried on in connection with the geological work for the State of Illinois, in progress at the same time under the direction of Professor Weller, in order to have the benefit of accurate determinations of the horizons from which the collections were made, with reference to the several subordinate formations into which the

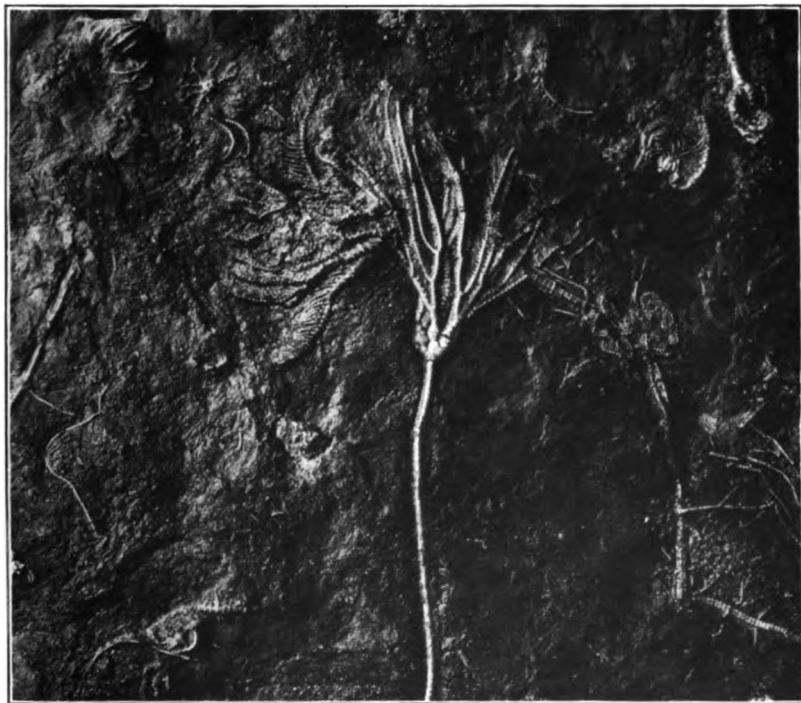


FIG. 17.—Portion of a slab of fossil Crinoids from Illinois.  
Photograph by National Museum.

Kaskaskia of that region is divided. In this way it was hoped to rectify some confusion as to the stratigraphic relation of a number of species described in the Geological Reports of Illinois and Iowa. The operations were successful in this respect, and at the same time six large boxes of fine specimens were obtained. Among the specimens there are a number of slabs covered with Crinoids not hitherto found in that formation, in an excellent state of preservation. A portion of one slab, containing 22 specimens of 9 different species, is shown in the accompanying illustration (fig. 17). This specimen and

others of similar character, giving a complete representation of the Kaskaskia crinoidal fauna, are being prepared for installation in the exhibition hall of the National Museum.

#### FURTHER EXPLORATION OF THE CUMBERLAND PLEISTOCENE CAVE DEPOSIT

In May, 1913, Mr. J. W. Gidley, assistant curator of fossil mammals in the U. S. National Museum, made a second visit to the Pleistocene cave deposit near Cumberland, Maryland, which proved even



FIG. 18.—Near view of part of excavation made near Cumberland, Maryland, by U. S. National Museum party. Photograph by Armbruster.

more successful than the one of the previous year, reported in the account of the Smithsonian explorations of 1912.

Many new forms were added to the collection, and much better material was obtained of several species represented only by jaw fragments in the first collection. The collection now contains upward of 300 specimens, representing at least 40 distinct species of mammals, many of which are now extinct. Among the better preserved specimens are several nearly complete skulls and lower jaws. The more important animals represented are two species of bears, two species of a large extinct peccary, a wolverine, a badger, a martin, two porcupines, a woodchuck, and the American eland-like antelope.



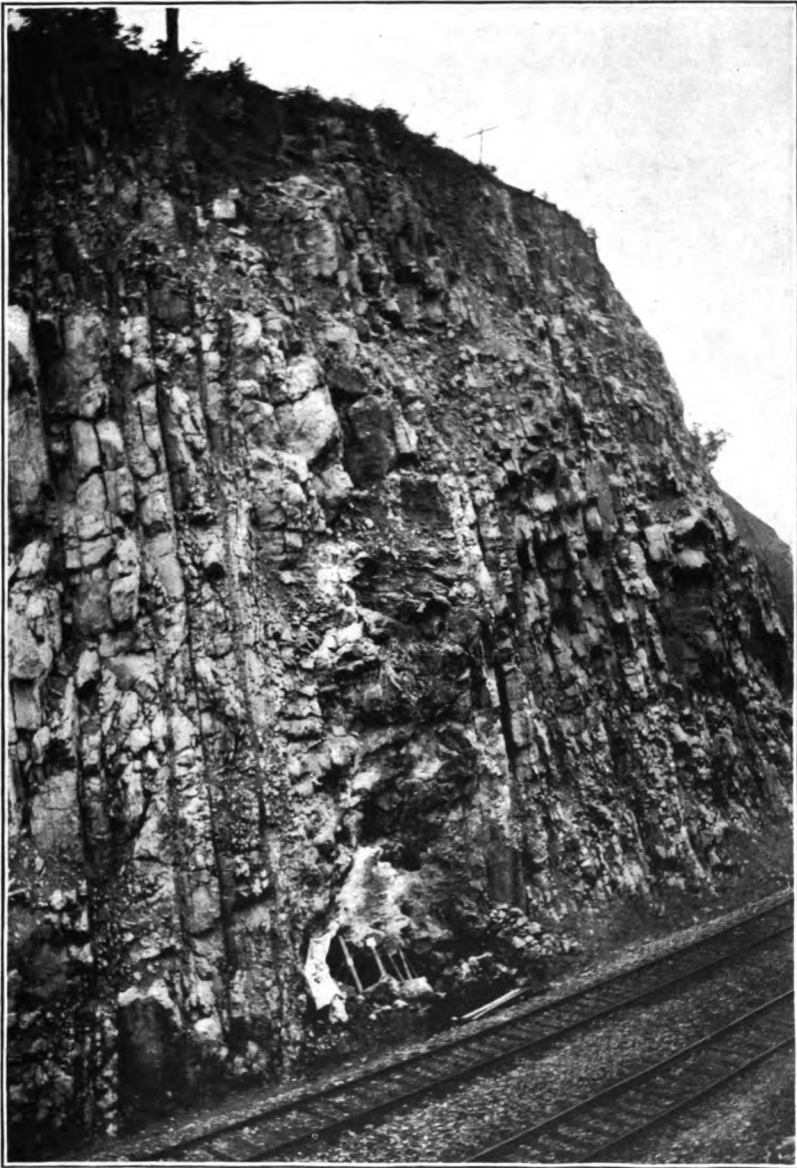


FIG. 19.—View from opposite side of railroad cut showing fossil deposits at bottom, near track, and traces of ancient opening at top of cliff. Photograph by Armbruster.

These species are all new and, with the exception of the American eland, the dog, and one of the bears, which Mr. Gidley has already described,<sup>1</sup> have not yet been named.

(Other species represented by more fragmentary material include the mastodon, tapir, horse, and beaver, besides several species of the smaller rodents, shrews, bats, and others.

This strange assemblage of fossil remains occurs hopelessly intermingled and comparatively thickly scattered through a more or less unevenly hardened mass of cave clays and breccias, which completely filled one or more small chambers of a limestone cave, the material together with the bones evidently having come to their final resting place through an ancient opening at the surface a hundred feet or more above their present location. The deposit is at present exposed at the bottom of a deep cut through which the Western Maryland Railroad has built its tracks. The railroad excavation first brought to light the ancient bone deposit and incidentally made access to the fossils comparatively easy. It is proposed to continue work on this important deposit during the next season.

#### A FOSSIL HUNTING EXPEDITION IN MONTANA

While engaged in Geological Survey work in northwestern Montana in 1912, Mr. Eugene Stebinger discovered a promising locality of vertebrate fossil remains. The following summer (1913), under the auspices of the U. S. Geological Survey, Mr. Charles W. Gilmore, assistant curator of fossil reptiles in the National Museum, headed an expedition for the purpose of obtaining, if possible, a representative collection from this area.

In July a camp was established on Milk River, some thirty-five miles north and west of Cut Bank, Montana, on the Blackfeet Indian Reservation. Four weeks were spent here in collecting, the work being confined entirely to the Upper Cretaceous (Belly River beds) as exposed in the bad-lands for ten miles along this stream. Later, in August, camp was moved some fifty miles south on the Two Medicine River, and two weeks were spent working in the same geological formation.

Taking into consideration the short time at the disposal of the party, the results of the expedition were most gratifying. Between

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<sup>1</sup> Smithsonian Misc. Coll., Vol. 60, No. 27, 1913.

Proceedings U. S. National Museum, Vol. 49, No. 2014, 1913.

500 and 600 separate fossil bones were obtained, many of them of large size. The most notable discovery was a new Ceratopsian<sup>1</sup> or horned dinosaur, the smallest of its kind known. There were portions of five individuals of this animal recovered, representing nearly all parts of the skeleton, so that it will be possible to mount a composite skeleton for exhibition. In this connection, it is perhaps of interest to know that, although Ceratopsian fossils were first dis-

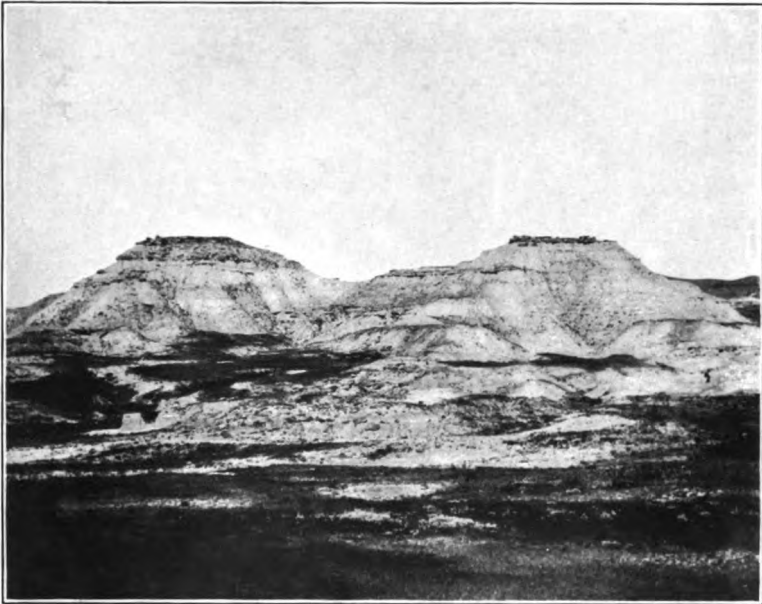


FIG. 20.—Fossil beds as exposed on Milk River, Montana. The small Ceratopsian dinosaur was found in the breaks in the foreground. Photograph by Gilmore.

covered in the Rocky Mountain region in 1855, and portions of a hundred or more skeletons have been collected, this is the first individual to be found having a complete articulated tail and hind foot. It thus contributes greatly to our knowledge of the skeletal anatomy of this interesting group of extinct reptiles.

Another noteworthy find was a partial skeleton of one of the Trachodont or duck-billed dinosaurs. This animal was only recently

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<sup>1</sup> Mr. Gilmore's description of this extinct reptile is to be found in the Smithsonian Misc. Coll., Vol. 63, No. 3, 1914.



FIG. 21.—Fossil beds as exposed on Two Medicine River, Montana. Camp of fossil hunters in the foreground. Photograph by Gilmore.



FIG. 22.—Fossil leg bone of a dinosaur shown as found in the ground, on Milk River, Montana. Photograph by Stebinger.

described from specimens obtained in Canada, and its discovery in Montana greatly extends its known geographical and geological range. The species was not before represented in the National Museum collections.

Less perfect skeletons of carnivorous and armored dinosaurs, turtles, crocodiles, and ganoid fishes were also obtained. Altogether the material is a most welcome addition to the fossil vertebrate collection in the National Museum, which has been deficient in representatives of this highly interesting but little known fauna.

#### LIFE ZONES IN THE ALPS

During the summer of 1904, Messrs. G. S. Miller, Jr. and Leonhard Stejneger, of the National Museum, visited the Western Alps in an endeavor to ascertain the limits of the life zones which, in that part of Europe, might correspond to those of North America established chiefly through the efforts of the U. S. Biological Survey. That a system of such life zones exists in Europe has long been more or less vaguely stated by authors, but although a definite correlation was established by the gentlemen mentioned, certain points, especially the interrelation of the zones corresponding to the so-called Canadian and Hudsonian life zones in America, were greatly obscured by the long continued interference of man and animals with Nature, such as the grazing of cattle in the high Alps, deforestation, and, more recently, artificial reforestation.

It was thought that the eastern Alps might show more primitive conditions, and in the spring of 1913, Mr. Stejneger took advantage of an opportunity to visit the mountain region between Switzerland and the head of the Adriatic, through a small grant from the Smithsonian Institution. Unseasonable and rainy weather interfered greatly with the carrying out of his investigation. He arrived in the town of Bassano at the foot of the Venetian Alps on April 20, 1913, it being his plan to study the life zones of the Val Sugana and the plateau of the Sette Comuni from that point. This plateau descends abruptly to the Venetian plain on the south, while to the east and north it is separated from the mass of the Eastern Alps by the Val Sugana, or the valley of the river Brenta, and on the west by the lower part of the valley of the Adige, or Etsch. It is intersected by the boundary line between Italy and Austrian Tirol.

From April 21 to May 6, he made a series of excursions from Bassano, Levico, and Trento as successive headquarters, during



FIG. 23.—Mouth of Val Frenzela, at Valstagna, northern Italy.  
Photograph by Stejneger.



FIG. 24.—Plateau of the Sette Comuni, northern Italy, looking east from Gallio. Monte Grappa in the background. The valley is the beginning of Val Frenzela. Photograph by Stejneger.

which time he completely circled the territory, and crossed the plateau once on foot. In spite of the backwardness of the season, he was able to trace the boundaries of the Austral life zones in considerable detail, as well as to gather data which connect with the previous correlation of these zones in the Western Alps and with the corresponding zones in North America. It was found that the bottom of the entire Val Sugana belongs to the Upper Austral zone. Owing to the rainy and inclement weather the results were less satisfactory in the higher regions, though some important data corroborating previous conclusions were obtained.

The time from May 7 to May 20 was spent in a study of the Etsch Valley in Tirol, from Trento to Schlanders, and of its tributary, the Eisak, from Bozen to its source on the Brenner Pass.

The elaboration of the detailed observations will be incorporated with a general report on the biological reconnoissance of the Western Alps.

To this preliminary statement are appended two illustrations showing the character of the country in which the observations were made. Figure 23 is a view of the mouth of Val Frenzela, the narrow valley through which the descent from the Sette Comuni was effected, near Valstagna, a small town a few miles north of Bassano. Figure 24 represents the plateau near the commune of Gallio, about 3,500 feet above the sea, looking east toward Monte Grappa and showing the beginning of Val Frenzela.

#### DR. ABBOTT'S EXPEDITION IN DUTCH EAST BORNEO AND CASHMERE

In continuation of the exploring and collecting carried on through the generosity of Dr. W. L. Abbott, by Mr. H. C. Raven, in Dutch East Borneo, it may be said that the work is going forward with excellent results.

Dr. W. L. Abbott is continuing his personal explorations in Cashmere, which he undertook a year ago, and, although the Museum has received no detailed report, some fine specimens of mammals have been added to the collections and many more are expected.

In a letter received in January, 1913, Dr. Abbott says that in his last shipment the only really good specimen is a queer little silvery grey shrew about 74 millimeters long, quite different from anything he has before seen, of which there are four specimens from Skoro Loomba, east of Shigar. There is also a magnificent snow leopard with its complete skeleton.



FIG. 25.—View from Leh, looking toward the Khardery Pass up the valley to the right. Observe the cultivation in terraces, all irrigated. The elevation is 11,200 feet. The hills in the background are from 20,000 to 21,000 feet elevation. Photograph from Abbott.



FIG. 26.—Shepherds with load-carrying sheep. Each animal carries from 12 to 30 pounds. They bring salt from Tibet to Ladak and carry back grain. Photograph from Abbott.



During the three months' trip which Dr. Abbott spent in Baltistan, in northwestern Cashmere, he secured about 289 skins which have been presented to the National Museum.

After a sojourn in England, he expected to return to Cashmere in May, and march to Ladak. He also intended to visit Nubra, and go east along the frontier to the Dipsang Plains where he hoped to secure specimens of a certain vole from Kara Korum Pass, as well as the little Tibetan fox, known to the Cashmere furriers as the "King Fox." At the time of the letter he anticipated a four months' trip during the summer of 1913.

This expedition, the results of which have been delayed in transit, was very successful. The small fox was obtained, also several wolves, lynxes, and many smaller mammals. The accompanying illustrations have been made from photographs sent by Dr. Abbott.

#### MARINE INVERTEBRATES FROM THE "EASTERN SHORE," VA.

In July, 1913, Mr. John B. Henderson, Jr., a regent of the Smithsonian Institution, and Dr. Paul Bartsch, of the National Museum, made a short trip to Chincoteague, on the Atlantic shore of Accomac County, Va., for the purpose of securing exhibition material of marine invertebrates and ascertaining the local marine fauna, particularly that of the mollusca. Owing to the inaccessibility of this strip of coast, generally known as the "Eastern Shore," collectors seem to have neglected it. At any event, there appear to be but few records and no critical lists published of the shallow water shells from any locality between Cape May, N. J., and Beaufort, N. C.

The chief objects of this trip were to determine of just what elements the molluscan fauna consisted; to see how many, if any, species of southern range lapped over from Hatteras, and what northern species still persisted in this faunal area. The collectors were fortunate in their somewhat haphazard choice of a locality, for they encountered at Chincoteague a greater variety of stations than can probably be found at any other point along this section of the coast.

Here there are interior sounds of very considerable extent which are very shallow (4 to 12 ft.), more or less thickly sown with oyster beds and with patches of eel grass, the bottom ranging from hard sand, through varying degrees of hard clay, to soft mud.

They found also the unusual feature of a bight or protected cove formed by the southward drift at the southern end of Assateague Island, protected from heavy wave action by a long, curved sand spit. This bight has a soft mud bottom, with a temperature possibly

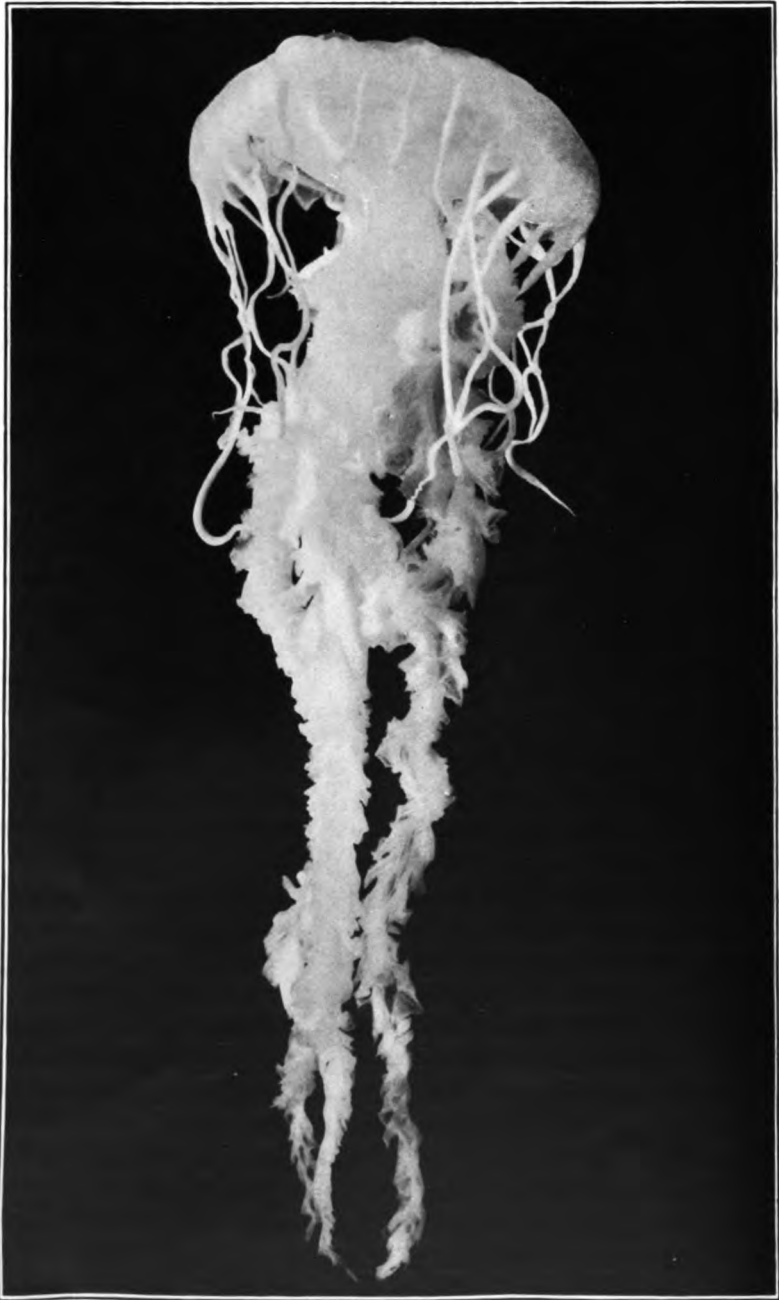


FIG. 27.—Medusa from Chincoteague, Virginia. Collected by Mr. Henderson and Dr. Bartsch. Photographed in alcohol by National Museum.

eight degrees less than that of the open sea. The mud brought up with the dredge seemed almost icy to the touch. This condition is probably produced by cold springs seeping through the floor of the bight. This colder water of the bight yielded to their dredge *Yoldia limatula*, large and fine, and *Nucula proxima*, whereas just around the protective spit of sand, on the ocean side, they found dead Terebras of two species, some young *Busycon perversa* and a valve of *Cardium robustum*; a somewhat startling association of species.

Then there was the open sea, which here presumably differs in no manner from other open sea stations along the 200 miles or more of this coast. The bottom drops off very gradually to the edge of the continental shelf, some 75 or 100 miles out. The open sea stations which they occupied were, as might be expected, very poor. The smooth, hard sand bottom seemed almost barren of life, and the softer patches that were explored contained only many dead shells, mostly small bivalves. The work in the open sea was scarcely a good test, although the collectors made probably 20 hauls reaching out from the shore some 4 or 5 miles, but the chart soundings indicated more promising areas of pebbly bottom a few miles beyond what they considered the safety zone for a small motor boat.

The inner waters of the sound were found to be unexpectedly rich in molluscan life, the species, for the most part, not having been taken previously outside or in the bight.

Only two full working days were spent here, where the party was fortunate in securing an excellent boat and obliging skipper. The material has been identified with great care, and the results of the expedition will be published in the Proceedings of the U. S. National Museum.

#### EXPERIMENTS WITH CERIONS IN THE FLORIDA KEYS

In the second issue of the Smithsonian exploration pamphlet,<sup>1</sup> attention was called to experiments with Cerions, conducted by Dr. Bartsch, under the auspices of the Carnegie Institution. The plantings of Bahama Cerions made upon the Florida Keys were visited in the latter part of April and early June by Dr. Bartsch, and a de-

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<sup>1</sup> Smithsonian Misc. Coll., Vol. 60, No. 30, 1913, pp. 58-62.

tailed report of his findings is published in the annual report of the Director of the Department of Marine Biology of the Carnegie Institution of Washington (Carnegie Year Book, 1913, pp. 217-219). The results of these experiments so far obtained may be summed up as follows:



FIG. 28.—"Peanut" shells on living vegetation, Key West, Florida.  
Photograph by Bartsch.

After looking over the entire plantings, Dr. Bartsch is inclined to believe that, with the exception of the Tea Table and Indian Keys, the colonies are doing as well as might be expected. It is also quite possible that when the young in the various colonies attain a larger size, a good many more will be found in the various places, in fact,

a good many may be present in places where they were not discovered previously, for the nepionic shells are quite small and hard to find.

Judging from the young collected, which were born on these Keys, the first generation will be like the parent generation unless decided



FIG. 29.—“ Peanut ” shells on living vegetation, Key West, Florida.  
Photograph by Bartsch.

changes should take place in the later whorls, which have not as yet been developed. The largest specimens found have only seven post-nuclear whorls, leaving two to three whorls still to be developed, and these make up fully half of the length of the shell. If the present



FIG. 30.—“Peanut” shells on dead stump, Key West, Florida.  
Photograph by Bartsch.

tendencies prevail in the adult shell, then it can be seen that the somaplasm has not at once responded to the change of environment. The reaction of the germ-plasm to the changed environment will await interpretation until the next generation presents itself.

Dr. Bartsch likewise kept a record of the birds seen on the various Keys visited between Miami, Florida, and the Tortugas, and has published this also in the Carnegie Year Book for 1913, pp. 220-222, with the hope that it may prove useful to students of bird migration.

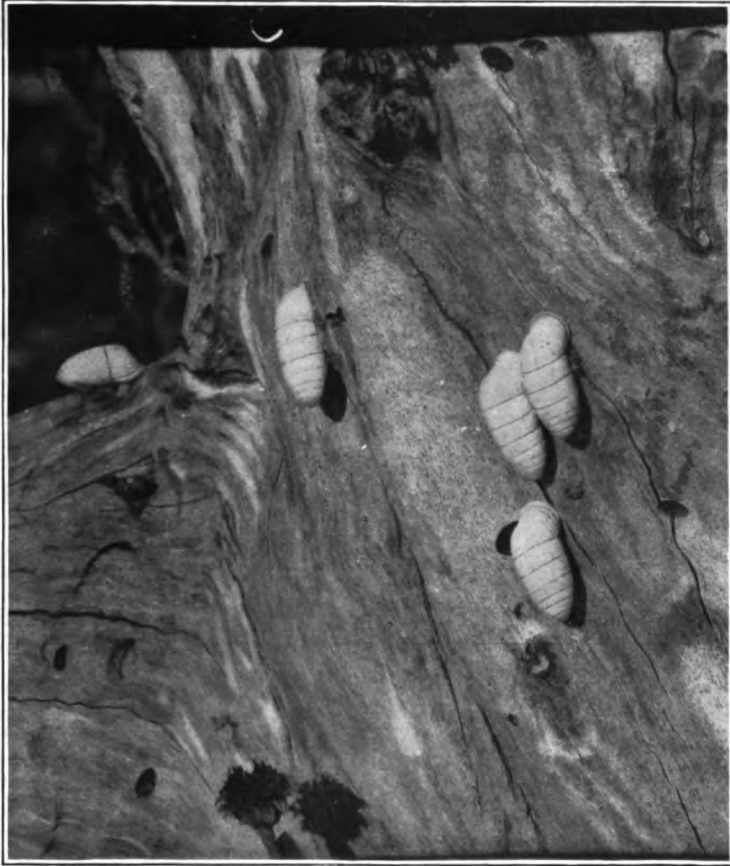


FIG. 31.—Detail view of "Peanut" shells on dead stump, Key West, Florida. Photograph by Bartsch.

#### BIRD STUDIES IN ILLINOIS

Mr. Robert Ridgway, curator of the division of birds, U. S. National Museum, has been working on the completion of National Museum Bulletin No. 50, *Birds of North and Middle America*, and has done some exploration work in the field in connection with this work.

Recently he made a trip to the Little Wabash River, about 16 miles southwest of Olney, Illinois, in order to ascertain what species of birds were wintering in the dense thickets of the bottom lands, and to obtain evidence as to the presence there of a decided element of the Austroriparian or Lower Austral fauna and flora.

Mr. Ridgway's residence in this locality during the winter has been of extreme interest; it is the first time he has had an opportunity to make natural history observations since his first trip to this region forty-seven years ago. He was thus enabled to compare present conditions with those existing on the occasion of his first visit, and has secured some valuable information for incorporation in his exhaustive monograph.

FISHES FROM THE REGION OF QUATERNARY LAKE  
LAHONTAN

The Museum has received through the Bureau of Fisheries a collection of fishes from the various river and lake basins that were



FIG. 32.—A breakfast catch of Tahoe Trout.  
Photograph by Snyder.

at one time connected with the quaternary Lake Lahontan. Twenty-one species are represented, 15 of which are native fishes, including not only all that are now known to inhabit the basin, but also 5 that are as yet undescribed. The collection was made by John O. Snyder, of Stanford University, while engaged in an investigation of the region under the direction of the Bureau of Fisheries.

Lake Lahontan, which in quaternary time was a large body of water, very irregular in shape, extended over a considerable part of





FIG. 33.—Mountain meadow in the high Sierra, one of the sources of the Truckee River. Photograph by Snyder.

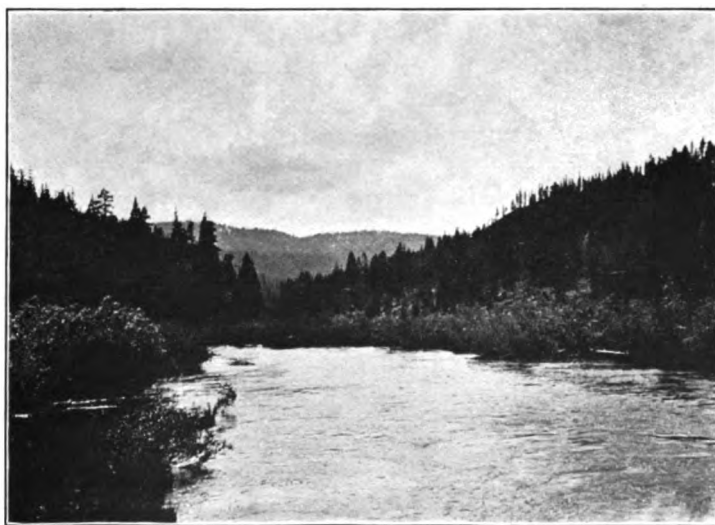


FIG. 34.—Truckee River, outlet of Lake Tahoe, California. Photograph by Snyder.

the region now included in northern Nevada and eastern California. It was no doubt a magnificent lake, including as it did a number of large and beautiful islands, with the great snow-capped wall of the Sierra on one side and the endless shimmering desert on the other. Even now, though dwindled and shrunken through desiccation, its glory has not all departed. For although one may travel for days over the wind-driven sands of its parched floor, the great terraces and castellated crags of its ancient shores tower at times hundreds of feet on either side, and there still remain a number of small though



FIG. 35.—Humboldt River near the Palisades, Nevada.  
Photograph by Snyder.

very beautiful lakes and several rivers of considerable size which were once tributaries of the greater lake. The waters of none of these reach the ocean but ultimately disappear through evaporation, or sink into the loose, dry sands of the desert.

Lake Tahoe, near the crest of the Sierras, 6,247 feet above the sea, has 195 square miles of clear water which reaches a depth of 1,645 feet. Its outlet, the Truckee River, plunges down 2,300 feet in a distance of about 100 miles, finally bifurcating and entering Pyramid and Winnemucca Lakes. The former is 30 miles long and 12 wide, the water having a depth of over 350 feet. It embraces some pictur-

esque islands, two of which should be permanently reserved by the Government, for they shelter thousands of birds during the nesting



FIG. 36.—The Needles, Pyramid Lake. Photograph by Paine.



FIG. 37.—Tufa domes, Pyramid Lake. Photograph by Paine.

season. Humboldt, Quinn, Walker, and Carson Rivers, and also Honey, Walker, and Carson Lakes are parts of this system.

These rivers and lakes are well supplied with fishes, exceedingly abundant in number, although representing but a few species. Of chief interest and value among these are the trout which appear to have found here the most advantageous conditions for growth and development. At least 2 native species occur, *Salmo henshawi*, the large cut-throat which occasionally reaches a weight of over 20 lbs., and *S. regalis*, the royal silver trout, much smaller than the former, but a most beautiful fish, remarkable for the brilliant silver of its sides and the unparalleled blue of its dorsal surface. Formerly the lakes and rivers of the region fairly swarmed with trout, and during the spawning season they often entered the rivers in such numbers that it was difficult for them to find room in the channels. Several species of suckers and large minnows occur in countless numbers.

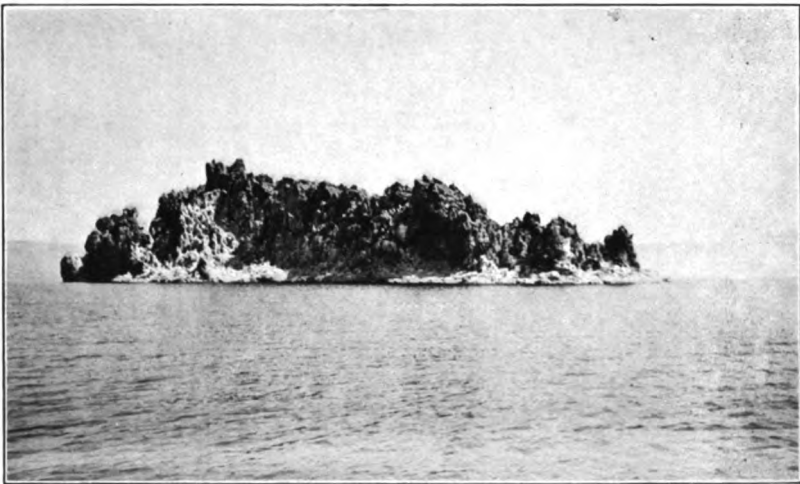


FIG. 38.—Bird Island, Pyramid Lake. Photograph by Paine.

Of these *Chasmistes cujus*, the Kouiewee of the Piute Indians, inhabits only Pyramid and Winnemucca Lakes. It lives in their depths, and is never seen until in the spring, when great schools suddenly appear at the mouth of the Truckee River, crowd up the channel and cover the bars, often pushing each other out of the water in their struggles to find room enough to deposit their eggs. Formerly this was an occasion of rejoicing among the Indians, for here were numbers of large, fat fishes which only need be kicked out of the water and hung on the bushes to dry. The Piutes still continue to cure them in large quantities for winter food. A small white fish abounds in favorable places. Some of the minnows reach a foot in length, bite

a fly or small spoon, and occasionally contribute to the camper's breakfast.

A study of the fish fauna of the basin bears out the conclusions of geologists regarding its long isolation. Nearly all of the species are distinct from those of neighboring systems, and some belong to groups of very restricted distribution. An account of the fishes, their habits and distribution will appear in a future bulletin of the Bureau of Fisheries.

#### CACTUSES AND DESERT PLANTS FROM THE WEST INDIES AND SOUTHWESTERN UNITED STATES

Dr. J. N. Rose, associate in botany, U. S. National Museum (at present connected with the Carnegie Institution of Washington



FIG. 39.—St. John's Harbour, British West Indies. The high point on the right is Rat Island, used as the Government Leper Asylum. Part of the town of St. John's is shown, the seat of government of the Leeward Islands under British control. Photograph by Russell.

in the preparation of a monograph of the Cactaceae of America). accompanied by Messrs. William R. Fitch and Paul G. Russell, spent over ten weeks in travel and field-work in the West Indies in the spring of 1913. As this was an unusual opportunity to obtain very valuable material needed for the collections of the National Museum and for use in making exchanges, the Museum detailed Mr. Russell

for the trip. This expedition formed a part of the larger scheme of studying in the field the desert plants of both North and South America, which had been organized by Dr. N. L. Britton, Director of the New York Botanical Garden, and Doctor Rose, in connection

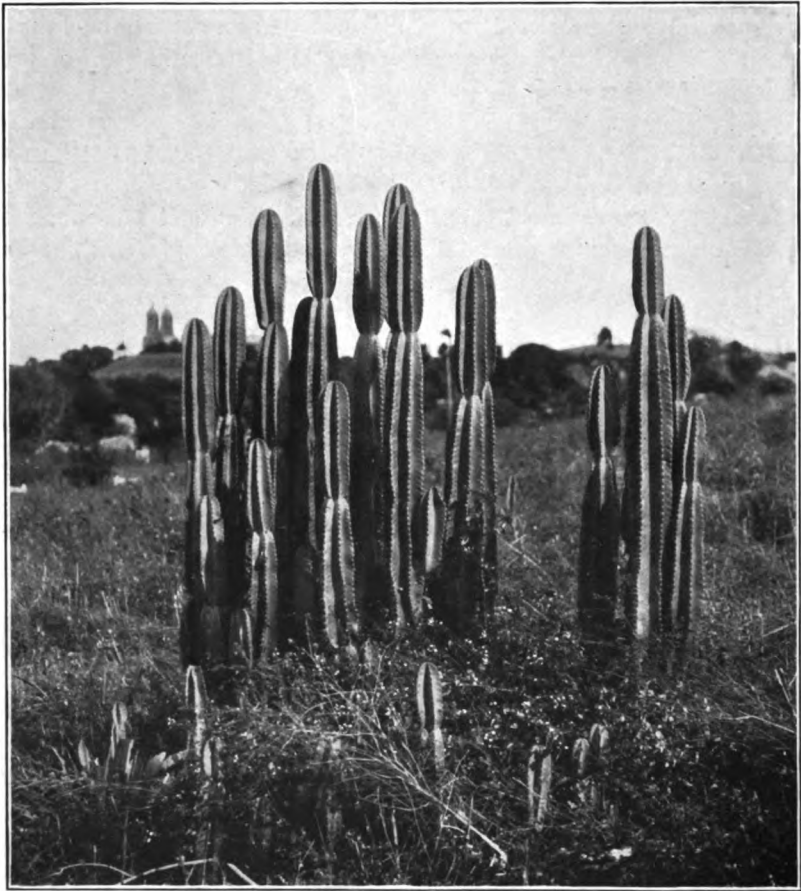


FIG. 40.—A *Cereus* (*C. lepidotus* Salm-Dyck) common on these islands. Near St. John's, Antigua. Photograph by Russell.

with their Cactus Investigation for the Carnegie Institution of Washington. Doctor Britton also took a party to the West Indies.

Both parties started from New York City January 25. Doctor Britton and his assistants explored St. Thomas, St. Jan and others of the Virgin Islands, Porto Rico, and Curacao. His collection consisted of more than 3,000 species, comprising two sets, one of which has been sent to the National Museum as an exchange.



FIG. 41.—A specimen of the Century plant (*Agave obducta* Trelease) showing an immature flowering stalk. Near English Harbour, Antigua. Photograph by Russell.



FIG. 42.—Specimens of the Melon-cactus (*Cactus intortus* Mill.) and Century plant (*Agave obducta* Trelease) on promontory near English Harbour, Antigua. English Harbour was once a fortified British stronghold. Admiral Nelson here fitted up part of his fleet for the Battle of Trafalgar. Photograph by Russell.



At the same time, Doctor Rose's party visited St. Thomas, St. Croix, St. Kitts, Antigua, and Santo Domingo. Knowing that the Museum greatly needed duplicates for exchange purposes, general collecting was done whenever possible. Dr. Rose's collection consisted of more than 1,200 species and about 7,000 specimens. Of these, one set has been mounted for the Museum and has become a part of the study series of the herbarium. A second set was sent to the New York Botanical Garden, while other sets have been sent to the Bureau of Science at Manila, and to the Royal Botanical Garden and Museum at Berlin, for use by Dr. I. Urban in the preparation of his Flora of Santo Domingo.

While especial attention was given to collecting the Cactus flora, a large general botanical collection was made. In this there are some new species, one in particular being a very remarkable *Annona* from the desert plain at Azua, Santo Domingo.

In addition to the herbarium material, 12 boxes and crates of living plants, chiefly Cacti, were sent from the West Indies by Doctor Rose, and two boxes of living plants were sent to Lady Katharine A. Hanbury's garden at La Mortola, Italy, in exchange for specimens and courtesies shown to Doctor Rose when in Europe in 1912.

Many packages of seeds, bulbs, cuttings, etc., were obtained for exchange purposes of the Museum or for study by the various workers in the U. S. Department of Agriculture.

#### PLANTS FROM SOUTHWESTERN UNITED STATES

In September and October, Doctor Rose, accompanied by Wm. R. Fitch, made extensive botanical collections in southeastern Colorado, New Mexico, and western and southern Texas. While the trip was made primarily for the purpose of collecting and studying the Cacti of this region, many other flowering plants were obtained, a full set of which has been mounted and placed in the National Herbarium.

#### THE FLORA OF WESTERN NORTH CAROLINA

During the latter part of August and early September, 1913, Mr. Paul C. Standley, of the Division of Plants, U. S. National Museum, and Mr. H. C. Bollman, of the Smithsonian Institution, spent four weeks camping in the mountains of western North Carolina, near Montreat, Buncombe County. Although undertaken primarily as a vacation trip, advantage was taken of the opportunity for study of the flora of this most interesting region. Over seven hundred speci-

mens of plants were secured, besides small lots of some of the common and easily collected animals. Special attention was devoted to the mosses, hepatics, and lichens, in which the region abounds, and a representative collection of each of these groups was secured. Lists of the species of cryptogams have been prepared for publication.



FIG. 43.—Mountain brook near Montreat, North Carolina. Photograph by Standley.

The mountains of North Carolina are of great interest botanically, since they support a varied flora, many of whose components are not found elsewhere. Western North Carolina was visited by some of the earliest American botanists who collected here the types of many of the typically mountain plants. Although numerous botanists have explored the region, many of its divisions are still unexplored and yield rich returns to the collector.

About Montreat the mountains are covered with an almost virgin chestnut forest, traversed by numerous small, swift streams of clear, cold water, bordered with hemlocks. There is an abundant undergrowth of rhododendron and laurel, two of the handsomest of North American shrubs, which attain their greatest perfection in the southern Appalachians. The herbaceous vegetation consists of many



FIG. 44.—Chestnut forest near Montreat, North Carolina. Photograph by Standley.

species, some of them of limited distribution. A small sphagnum bog, in particular, yielded a large number of rare plants.

The most interesting excursion made during the month's camp was to the summit of Mount Mitchell, the highest peak in eastern North America—6,710 feet. By trail, it is distant about sixteen miles from Montreat. The trail at first follows a logging railroad which is being extended into the mountains, then strikes through the heavy

spruce and balsam forest covering the higher slopes. This primeval forest, which resembles in its general appearance those of the Rocky Mountains, unfortunately seems destined to disappear in the near future; indeed, it has already been removed from a large area, and desolation left in its stead. It is deeply to be regretted that as Mount Mitchell is made more accessible by the railroad its chief beauty will be destroyed.

A single night was spent on the summit of the mountain. A cabin was built here and maintained by the State some years ago, but it is now abandoned and has fallen into decay. At the summit of Mount



FIG. 45.—Artificial fountain near Black Mountain, North Carolina. It is fed from a reservoir on a neighboring mountain. Photograph by Standley.

Mitchell is a monument which marks the grave of the man whose name it bears, who lost his life while engaged in exploring its slopes. From this point at sunrise a wonderful view is obtained of the vast mass of mountains which cover the adjacent region, their valleys filled with a sea of clouds above which the higher peaks rise like rugged islands.

A small collection of plants was made upon the peak, a locality whose flora is little known. The flora, strangely enough, is not particularly interesting, for it includes but few species. The vegetation is remarkable chiefly for the large number of introduced plants it includes. These have doubtless been transported by the visitors who ascend the mountain each year. In spite of the altitude of Mount

Mitchell, it yields none of the boreal plants which make the floras of the mountains of New England so interesting. The lower mountains of North Carolina, and some of the other high peaks, are much more interesting botanically than this, the loftiest of them all.

#### ANCIENT MICA MINES OF NORTH CAROLINA

In April, 1913, W. H. Holmes, head curator of the department of anthropology, visited the mica mines of western North Carolina, making such observations as seemed necessary for a reasonable comprehension of the nature and extent of the ancient operations.

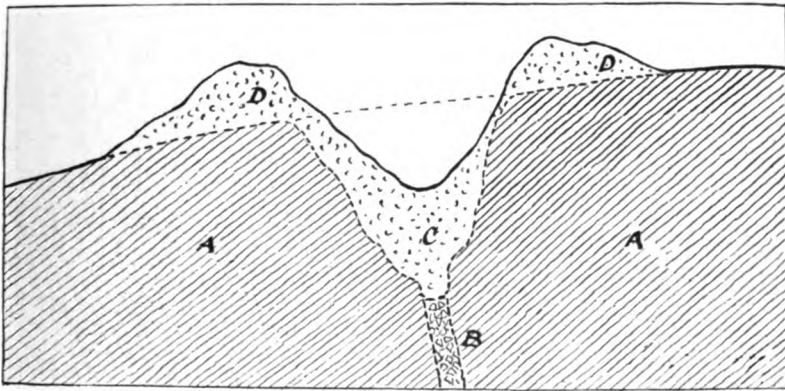


FIG. 46.—Section of an aboriginal mica mine: *A*, General schistose formation; *B*, Mica-bearing vein; *C*, Old digging partly filled up; *D*, Ancient dumps.

Mica was in very general use among the Indian tribes east of the Great Plains and was mined by them at many points in the Appalachian highlands from Georgia to the St. Lawrence River. From these sources it passed by trade or otherwise to remote parts of the country and is found especially in burial mounds, stone graves, and ordinary burials throughout the Mississippi Valley. The crystals of mica are of diversified shapes and sizes, reaching in some cases upwards of two feet in dimensions. They separate readily into sheets of very attractive appearance, which are transparent or translucent, displaying various silvery and amber hues. Mica crystals occur distributed through narrow veins of quartz and feldspar which extend at various angles through the inclosing schistose formations.

Although probably serving few practical purposes the sheets were highly prized by the aborigines for the manufacture of personal or-

naments and for sacrificial and mortuary purposes. It is stated on good authority also that they were used as mirrors.

Mr. Holmes visited a number of mines in the vicinity of Spruce-tree and Bandana, Yancey County, and near Bakersville in Mitchell County. The most important workings in the first mentioned locality are known as the Sink Hole mines, near Bandana. Although these mines have been operated extensively in recent years, sufficient traces of the old work remain to convey a fair notion of the nature and extent of the prehistoric mining. There are two main groups of pittings, each approximately 1,000 feet in length and 20 to 60 feet in

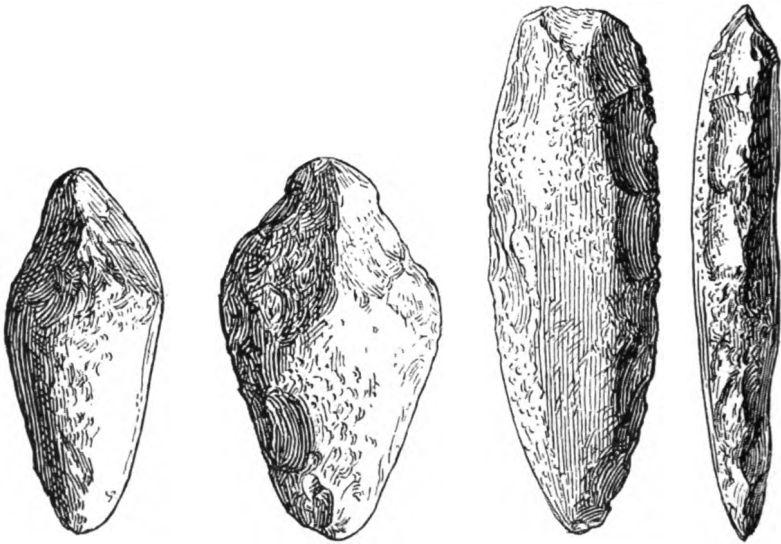


FIG. 47.—Stone picks used in excavating and freeing the crystals of Mica.

width. The original depth in many cases was upwards of 40 feet, but recent operations of white miners have served to change their appearance, and to fill up the deeper excavations. The pittings are surrounded by a somewhat uneven ridge of detritus derived from the excavations, which has been added to in places by the modern miners, and has been dug into of late years to recover the mica rejected and thrown out by the aborigines.

An important site of the ancient operations now known as the Clarissa mine, three miles east of Bakersville, Mitchell County, was also visited. This is probably the best preserved and most striking of the aboriginal workings in this general region, and serves to illustrate the importance of the mica industry in prehistoric times. Entering a

low ridge at an oblique angle, the excavation reaches a depth of nearly 100 feet. The outer margin is buried beneath heavy bodies of ancient dump material which now supports numerous chestnut trees, the trunks of which are four or five feet in diameter. The modern operators of the mine who have worked the vein at the upper end to the depth of 300 feet have filled the old trenches deserted by the aborigines.

So far as could be determined, the implements used in excavating the decomposed schists and breaking up the vein material, thus freeing the mica crystals, were rude picks and hammers of stone, a few examples of which were found. Drawings of these are shown in figure 47.

Mr. Holmes extended his reconnoissance into South Carolina, where an ancient mound of large dimensions, situated twelve miles below Columbia on the Congaree River, was examined. A plan of the mound was made, and an examination of an ancient burial site on the edge of the mound yielded numerous relics of pottery and stone.

Near Waynesboro, Georgia, a number of ancient village sites and certain outcrops of flint, where the aborigines had obtained the material for their implements, were examined. Later, in the spring, Mr. Holmes visited St. Louis, Missouri, with the view of studying the very interesting collections owned in that city, and accompanied by Mr. Gerard Fowke spent a day at Mill Creek, Illinois, making collections on the ancient quarry and shop sites of that locality. He later extended his excursion to Davenport, Madison, Milwaukee, Chicago, and Columbus, for the purpose of making studies in the museums of those cities.

#### ANTHROPOLOGICAL EXPLORATION IN PERU

Dr. Aleš Hrdlička, of the National Museum, has made a second report<sup>1</sup> concerning his field-work in Peru during the past year, in connection with the Panama-California Exposition at San Diego, for which a very important exhibit in physical anthropology is being prepared. The investigations extended over several hundred miles of the Peruvian coast and over hitherto unexplored regions in the western Cordilleras. The objects of this trip, which occupied the first four months of 1913, were to determine the anthropological relations

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<sup>1</sup> Anthropological Work in Peru in 1913, with Notes on the Pathology of the Ancient Peruvians. Smithsonian Misc. Coll., Vol. 61, No. 18, 1914.

of the ancient Peruvians of the mountains with those of the coast, and to extend the investigations which Dr. Hrdlička has carried on for many years, regarding Indian and especially pre-Columbian pathology.

The expedition was a very strenuous one, but proved remarkably successful. Over 100 ancient cemeteries and many ruins, a large



FIG. 48.—The picturesque town of Huarochiri, in the western Cordillera of central Peru. Photograph by Hrdlička.

percentage of which were previously unknown to science, were examined and over 30 boxes of skulls and other material for future study were collected for the U. S. National Museum and the Museum at San Diego.

Dr. Hrdlička reports that skeletal material, which formerly abounded in Peru and is essential to scientific research, is fast disappearing, and in a few years can not be gathered without the expenditure of much time and money.



The results of the expedition will prove of unusual value to anthropology. While some of the links in the chain of evidence are still missing, it can now be said with certainty that the Peruvian coast from Chiclayo, in the north, to Yauca, in the south—a distance of over 600 miles—was peopled predominantly before the advent of the whites by one and the same physical type of Indian. These Indians were of medium height, with short and broad skulls, and



FIG. 49.-The ruins of the Incaic Temple of the Sun, at Pachacamac, Peru.  
Photograph by Hrdlička.

moderately to strongly developed muscles according to the locality. The most important fact ascertained in this connection was that both the Chimu and Nasca, two of the foremost cultural groups of ancient Peru, were identical and, as regards physical characteristics, inseparable parts of this coast people.

According to their location, the people of old Peru were either fishermen or farmers. They seem to have been organized into numerous political groups, which developed smaller or greater cultural differences according to environment and other influences.



FIG. 50.—Ancient cemetery in Peru; a typical example of the waste of pottery and bones by the despoiling peons. Photograph by Hrdlička.



FIG. 51.—Cache, by the explorer, of ancient pottery left behind by vandals after despoliation of a cemetery south of Huacho, Peru.  
Photograph by Hrdlička.

Some of their smaller dwellings were made of reeds, while larger structures were built of small uncut stones, sun-dried brick, or blocks of adobe. Their knowledge of weaving, pottery-making, and decoration was surprising. They wove from native cotton and llama wool, and their designs indicate changes brought about by time and other influences. The native dress consisted principally of a poncho shirt, a loin cloth, and sandals, with occasionally a simple head-gear.

The pre-Columbian Peruvians of the coast knew the uses of gold,



FIG. 52.—Indian hut and inhabitants, with a ruin-covered hill known at Llacxwa, in the rear, located in the Sierras, south-east of Nasca, Peru. Photograph by Hrdlička.

silver, and copper, and worked these metals to some extent, especially copper or "bronze" in the manufacture of weapons. Their common weapons were a metal or stone mace, a wooden club, a copper axe and knife, the sling, and in some regions the bow and arrow. Their implements were the whorl, weaving sticks, looms, cactus-spine or bone needle, bone needle-holders, sharpened sticks, copper knives and axes, hoes and fishing paraphernalia, including nets, sinkers, reed-bundle boats or balsas, and peculiar rafts which were paddled.

Throughout the whole territory along the coast the people deformed the heads of their infants by applying pressure to the fore-

head probably by means of pads and bandages, which process flattened the back of the head as well. They did not practice filing, cutting, or chipping the teeth, or other mutilations which would leave marks on the skeletons.

These natives seem to have been free from general bodily ailments before the advent of the white men; on the other hand they suffered from several peculiar local diseases affecting the hip-bone, the head, and the ear.



FIG. 53.—A party of vandals in an old cemetery on the railroad from Ancón to Huacho, Peru. Photograph by Hrdlička.

The people of the mountains possessed a good average development of the body and of the skull, and were even freer than the coast people from disease. Wounds were, however, common, and in some of the districts serious wounds of the head were frequently followed by the operation known as trepaning, and although this was often crudely done, it was successful in many cases. This practice was probably carried on even after the coming of the Spaniards.

The results of the expedition failed to strengthen the theories of any great antiquity of man in Peru, tending rather to prove the con-

trary. Aside from the cemeteries or burial caves of the common coast or mountain people, and their archeological remains, there was no sign of human occupation of these regions. Not a trace suggesting anything older than the well-represented pre-Columbian Indian was found anywhere; and neither the coast nor the mountain population, so far as studied, can be regarded as very ancient in the regions they inhabited. No signs indicated that any group occupied any of the sites for even as long as 20 centuries; nor does it seem that any of these people developed their culture, except in some particulars, in these places.

#### ARCHEOLOGICAL EXPLORATIONS IN WESTERN NEW MEXICO

Mr. F. W. Hodge, ethnologist-in-charge of the Bureau of American Ethnology, in the early autumn of 1913 made a reconnoissance of



FIG. 54.—Character of masonry shown in one of the house-groups of the compound. Note the failure of the builders to “break” the joints and the consequent weakening of an otherwise excellent wall. The face of the stones is pecked to smoothness and all the stones are artificially squared. Photograph by Nusbaum.

a group of ruins on a mesa rising from the southwestern margin of the Cebollita valley, about 20 miles south of Grant, Valencia County, New Mexico, and only a few yards from the great lava flow that has spread over the valley to the westward for many miles. While no very definite information regarding the origin of this ruined pueblo

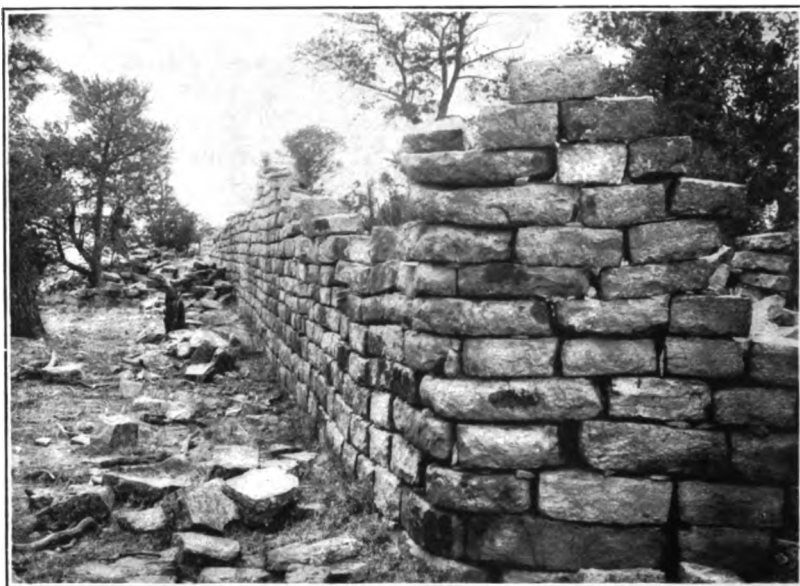


FIG. 55.—Stone outer wall of a defensive structure near the mesa rim. This wall is about 132 feet long in the clear, and is pierced only by small loop-holes. Photograph by Nusbaum.



FIG. 56.—Skeleton, with burial accompaniments, found in a small cist. Photograph by Nusbaum.

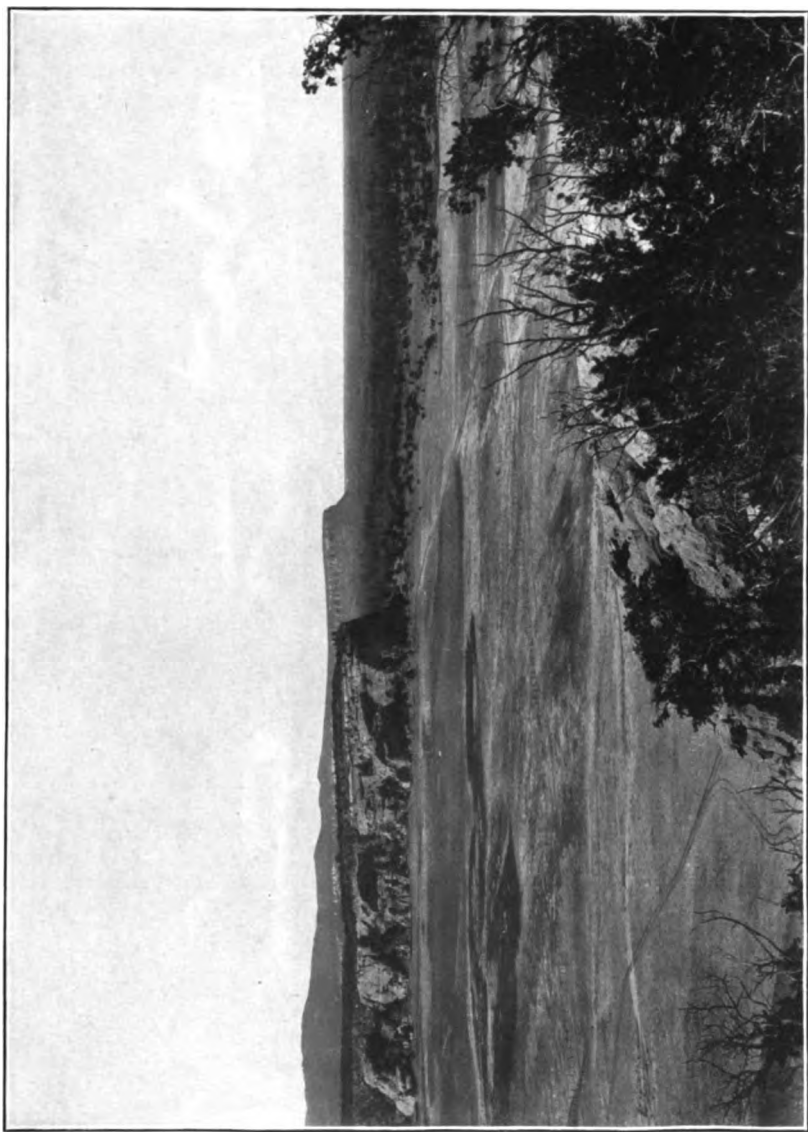


FIG. 57.—View southward across Cebollita valley, New Mexico. The lower mesa across the valley is that on the summit of which are situated the chief ruins described. Photograph by Nusbaum.

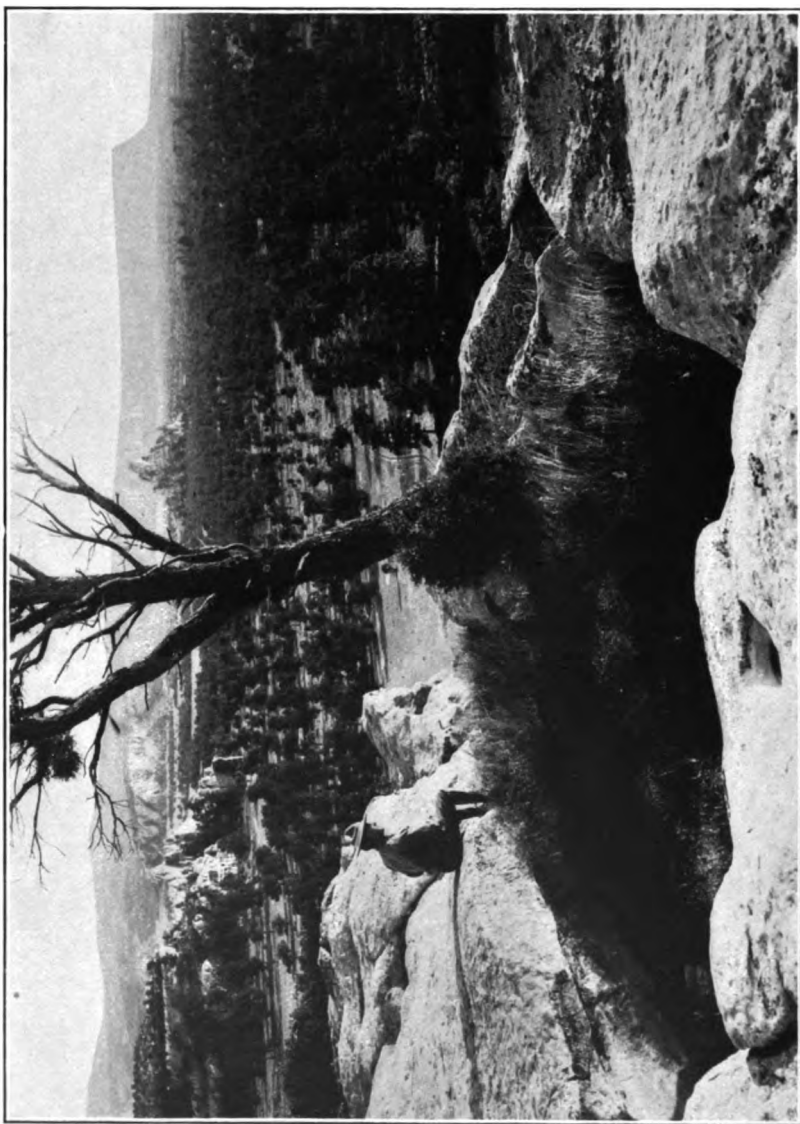


FIG. 58.—Smaller reservoir, probably chiefly a natural depression, in the rocky floor of the mesa-top; looking southward. Photograph by Nusbbaum.



has yet been obtained, there is reason to suppose that it was occupied by ancestors of the Tanyi, or Calabash, clan of the Acoma tribe, and is possibly the one known to them as Kowina.

These ruins consist of a number of house-groups forming a compound, built on an almost impregnable height, and designed for de-

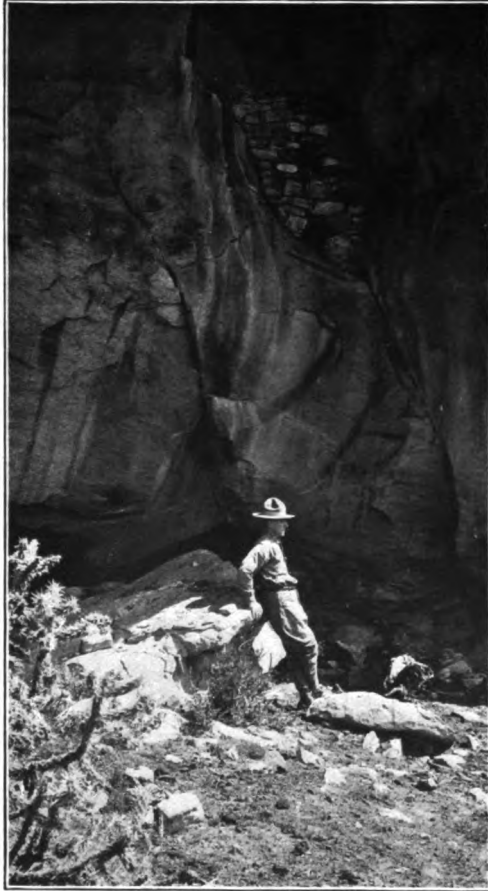


FIG. 59.—Small cliff-house on the northern side of Cebollita valley. Photograph by Nushaum.

fence; not only the groups but the individual houses have the form of fortifications, while the vulnerable point of the mesa rim is protected by means of a rude breastwork of stones.

The outer wall, which protects the whole mesa, is built of exceptionally fine masonry, probably the finest work to be found in ancient

pueblo ruins of the Southwest. The building stones have been dressed to shape, matched for size, and their faces finished by pecking, with such labor as to confirm the belief that this ancient village was designed for permanent occupancy. Altogether the work proves of great interest, and it is suprising to note the one failing, on the part of these early builders: they seem to have been unaware of the necessity of breaking the vertical joints in the courses of masonry, thus causing many weak points in the otherwise excellent walls.

Among the special features of interest which Mr. Hodge discovered were a burial cist where skeletons, pottery, and the remains of a mat were found; three small cliff lodges situated in the sides of the cliffs; several ceremonial rooms or kivas associated with the ruined houses, and the remains of the early reservoirs of the inhabitants.

A full report on the exploration of this interesting pueblo will be made by Mr. Hodge in a later publication.

#### ANTIQUITIES OF THE WEST INDIES

Dr. J. Walter Fewkes, ethnologist in the Bureau of American Ethnology, spent January, February, March, and part of April, 1913, in the West Indies, studying the prehistoric antiquities of the Lesser Antilles, and gathering material for a proposed monograph on the aborigines of these islands. He examined numerous local collections, and visited many village sites, prehistoric mounds, shellheaps, and boulders bearing incised pictographs.

The most extensive excavations during these months were made at Erin Bay, Trinidad, in a shellheap of considerable size, where he found a valuable collection of animal heads made of terra cotta and stone, and other objects illustrating the early culture of that island. From Trinidad he went to Barbados, where he found evidences of the former existence of cave people living in a shell age or one in which stone was replaced by shell. Excavations were later made at a village site of the Black Caribs at Banana Bay, Balliceaux, a small island near St. Vincent, and a small collection was gathered from it.

He obtained many drawings of specimens in a rich collection from St. Kitts and Nevis, owned by Mr. Connell, and examined the shellheaps at Salt River, Christianstadt, St. Croix, and at Indian River, Barbados. The collection of prehistoric objects obtained from St. Croix, Danish West Indies, was ample to prove that the early culture of the inhabitants of this island was more closely related to the culture

of Porto Rico than to that of St. Vincent. The material obtained in this field-work will be embodied in a report which Dr. Fewkes has in preparation on the magnificent collection of West Indian prehistoric objects owned by George G. Heye, Esq., of New York. The exploration was done in coöperation with the Heye Museum.

Field-work in the West Indian islands was supplemented by a visit to those museums in Europe where extensive Antillean collections exist. August, September, and October were devoted to studying prehistoric West Indian objects in Berlin, Bremen, Copenhagen, Vienna, and Leipzig. While in the first mentioned city he employed Mr. W. von den Steinen to make drawings of the originals of the Guesde Collection and many other objects from Hayti, Porto Rico, and the Lesser Antilles.

In the Bremen Museum a stone collar was found to have its knob modified into a reptilean head, an unique feature that would seem to shed light on the meaning of these objects. The Museum at Copenhagen has a rare ceremonial celt connecting petaloid stone axes with stone heads.

These field-studies and examinations of museum specimens have led Dr. Fewkes to the conclusion that in prehistoric times there existed in the Antilles a race of sedentary people having a form of culture extending from Trinidad to Porto Rico. This culture differed in minor details, in the various islands, as the style of stone implements, pottery, and other objects of material culture in all these islands shows. It was preceded by a life in caves which survived in western Cuba and the western peninsula of Hayti down to the time of the discovery by Columbus. The Caribs, who came comparatively late, brought a different culture that overlaid and, in a measure, absorbed the preceding culture in the Lesser Antilles. In other words, evidences were found of at least three distinct types of culture in the Lesser Antilles: cave, agricultural, and Carib. The second or agricultural type was found to have the subdivisions localized in the following groups of islands: Cuba, Santo Domingo, and Porto Rico; St. Kitts, including Nevis; the volcanic chain of islands from Guadeloupe to Grenada; Barbados; and Trinidad.

As with all other sciences, the highest form of research in culture history is comparative. It is universally conceded that the race inhabiting the New World, when discovered, had not advanced in autochthonous development beyond the neolithic age, whereas in Asia, Europe, and Africa a neolithic age was supplemented by one in which metals had replaced stone for implements. In the Old World

this polished stone epoch had been preceded by a paleolithic stone age not represented, so far as is known, in America. The ethnology and archeology of our Indians therefore form only a chapter, and that a brief one, or a segment of a much more extended racial evolution, as illustrated in Asia, Europe, and Africa.

It is profitable to compare the neolithic stone ages in the New World and the Old in order to appreciate rightly the position of the American Indian in the advance of human history, and his relation to the dawn of human history.

In order to carry on comparative studies of the stone age of aboriginal America and the corresponding age in the Old World, Dr. Fewkes spent six months in field and museum work in Europe and Africa. He visited the prehistoric mounds, dolmens, and megalithic monuments at Stendal and Stöckheim in Altmark, a short distance from Berlin, and examined the finely installed collections from these localities in local museums. He also visited the island of Rügen, in the North Sea, where there are many prehistoric mounds, Huns' graves, workshops, and megalithic and other remains of the neolithic inhabitants. The many antiquities from this island in the museum at Stralsund furnished considerable data for a comparative study of artifacts from this part of Europe with similar objects from North America.

Dr. Fewkes believes that the time is past when the great ruins in our Southwest should be left to destruction by the elements, after smaller objects have been extracted from them. In order to protect these ruins he has inaugurated, under the direction of the Smithsonian Institution, at Casa Grande, Spruce-tree House, and Cliff Palace, a scientific method of excavation and repair. In order to improve his methods by becoming better acquainted with excavation and repair work adopted by the ablest European archeologists, he visited Egypt, Greece, and Italy (Pompeii).

He found in some cases that whereas repair work in the Old World is often neglected and cannot be called very scientific, and some of the excavated ruins have been left in very bad condition for future students, the majority are being carefully protected after excavation, in a manner well worth study by those who aspire to the most advanced standards.

The best archeological repair work in Egypt may be seen on the Temple of Amen Ra at Karnak, and the mortuary temples, the Ramesseum, Medinet-Habu, and the Seteum, from which were obtained valuable suggestions. The admirable repair of the hypo-style

hall of the Temple of Amen Ra, by M. Le Grain, is the most important ever attempted on an ancient building.

Part of his time in Egypt was devoted to comparative problems, and he was also able to give some attention, all too limited, to evidences of convergence and parallelism in the neolithic or predynastic culture of the Nile Valley with that of the Gila. He investigated more especially remarkable lines of similarity in artificial methods of water supply, in both regions, and the influence of coöperation of predynastic villages in building great irrigation canals, on the development of a higher social organization. He had always in mind the collection of material bearing on interrelationship of climatic conditions and early culture in the Nile Valley.

#### AMONG THE EAST CHEROKEE INDIANS OF NORTH CAROLINA

Mr. James Mooney, ethnologist in the Bureau of American Ethnology, spent the summer of 1913, June 18 to October 4, inclusive, with the East Cherokee Indians in the mountains of western North Carolina, among whom he had made his first field studies in 1887. These Indians, numbering some 1,000, live upon a small reservation in Swain and Jackson Counties with several outlying settlements farther to the west. They are a part of the historic Cherokee Nation formerly holding the whole mountain region of the southern Alleghenies until removed by military force in 1838 to the Indian Territory, where they now number about 30,000 of pure or mixed blood. Those in North Carolina are the descendants of some hundreds who made their escape from the troops and were finally, through the good offices of their friend, Col. Wm. H. Thomas, allowed to remain and settle upon lands purchased for them with their share of the fund originally appropriated for their removal to the west. There are still living among them several who remember the removal.

Constituting from the beginning the most conservative and pure-blooded element of the tribe, protected by their mountain barriers from outside influences and never having been subjected to the shock of forced removal to a distant and strange environment, these East Cherokees remain to-day the conservators of the ancient traditions, and exemplars of the aboriginal life once common in varying degree to all the tribes of the Gulf States. Until 1881, when the first school was established, they continued virtually unchanged. Since then, schools, railroads, and lumber industries have made rapid advance, which, with the passing of the older generation, must before many years bring to a close the Indian period.

On this occasion, Mr. Mooney made headquarters in the largest and most conservative settlement, locally known as Raven Town or Big Cove, some 12 miles from the agency, over a very rough mountain road impassable for vehicles during a part of the year. Here, shut in by the highest peaks east of the Mississippi, some 500 Indians dwell in fairly comfortable two-room log cabins perched high up on



FIG. 60.—Cherokee potter; Katâlsta, daughter of Yânagûski, "Drowning Bear," Head chief of the East Cherokee about 1838. Photograph by Mooney.

the slopes of the mountains, always near a convenient spring. They till their fields of corn and beans, which extend sometimes even up to the crest of the ridge. Some have oxen, and a few have horses, but the great majority cultivate their fields by hand, and travel always on foot.

While many are nominally Christians, and most of the younger people can speak English, they still, as a community, adhere to their

ancient rites of the Green Corn dance, the "going to water" at every new moon, the fishing and hunting charms, the medicine man, and the native ball game. Many of the women are expert in basket making, in a variety of patterns, but the pottery art, which flourished a few years ago, is now virtually extinct. The blow-gun, formerly used for shooting small game, is now almost a thing of the past, together with the head turban and the moccasin.

Although the outer life and semblance are thus altered, the possession of a native alphabet or syllabary, invented by a mixed blood of the tribe nearly a century ago, has enabled their priests and doctors to preserve their ancient ritual prayers and formulas without change and apparently almost without diminution from the remote past. By good fortune some twenty-five years ago Mr. Mooney was enabled to obtain some hundreds of these Cherokee manuscript formulas, the secret possession of their leading priests. Many others have been obtained on later visits, in addition to much miscellaneous ethnologic material, until the collection now numbers approximately 600 formulas, perhaps the equivalent of as many printed quarto pages, covering every occasion of Indian life, war, love, hunting, fishing, agriculture, medicine, games and ceremonials. This collection of aboriginal American literature is unique and without parallel. As a revelation of primitive psychology it is invaluable. The antiquity of the formulas is sufficiently indicated by the abundance of archaic forms and references, many of which cannot now be explained even by the priests, who simply say, "This is the way it was given to us." Many of these formulas are highly poetic.

The explanation of those originally obtained, almost one-half the whole collection, was procured from the principal recognized priests of that time, all of whom are now dead. At the same time, all the words of the formulas were glossarized, and all the plants mentioned in the medical prescriptions collected, and labeled with their Indian names, and later identified botanically by experts of the Smithsonian Institution. Other formulas have been translated and explained during subsequent visits. During the last summer the number was considerably enlarged by the best known teachers. All those then untranslated were translated and glossarized, and the additional plants named therein collected. The whole body was then revised from the beginning, so that nearly every formula has now had the interpretation of at least three recognized authorities. There is still a paucity in certain classes as compared with others, notably in the formulas relating to war and to the ball play, as compared with those relating

to medicine and love. This deficiency may be supplied by future gatherings, but for the formulas already translated, it may be confidently affirmed that no important additional light is now procurable.

While the formulas constitute the largest body of aboriginal American literature extant, the plant collection constitutes probably the largest ethno-botanic collection from any one tribe, comprising some 700 species with Cherokee names and uses, nearly all of which have been scientifically identified by expert botanists. This collection represents the combined plant knowledge of the principal doctors in the tribe.

Opportunity was also afforded for special studies and observations, particularly of the ceremonial "going to water," and augury with the beads to forecast the health prospect and life-span of each member of the family, before partaking of the first corn of the new crop.

#### CEREMONIAL DANCES OF THE CREEKS IN OKLAHOMA

In July and August, Dr. John R. Swanton of the Bureau of Ethnology visited the territory of the old Creek Nation in Oklahoma.



FIG. 61.—The "Feather" dance, Fish Pond square ground.  
Photograph by Swanton.

to attend several of the ceremonial dances or busks about which he had collected much information in previous years. He witnessed four of these ceremonials: that of the Eufaula Creeks near Eufaula, McIntosh County, those of the Hilibi and Fish Pond Creeks near Hanna, in Hughes County, and that of the Tukaba'tci near Yeager. Notes were taken on all of them and a number of photographs were obtained of the first three. Considerable supplementary information





FIG. 62.—The women's dance, Fish Pond square ground.  
Photograph by Swanton.



FIG. 63.—"Feather" dance, Hilibi square ground. Photograph by Swanton.

was secured from the older men regarding the busk ceremonial and other ancient usages.

When the ceremonies were over Dr. Swanton visited the Indians in Seminole County, who still speak Hitchiti, a language formerly current throughout southern Georgia, and recorded several texts. He also secured the coöperation of a Hitchiti Indian, able to write in the missionary alphabet, to obtain other texts after his departure.

#### CEREMONIES AND RITUALS OF THE OSAGE

During the year 1913, Mr. Francis LaFlesche of the Bureau of American Ethnology secured the songs and rituals of five different Osage ceremonies. Two of these are practically complete; the others are fragmentary, but enough information was obtained to give a fair idea as to their significance. These rites are: Wa-dó-ka We-ko, Scalp Ceremony; Wa-zhiŋ-ga-o, Bird Ceremony for boys; Wa-wa-thon, Peace Ceremony; Zhiŋ-gá-zhiŋ-ga Zha-zhe Tha-dse, Naming of a Child; and We-xthe-xthe, Tattooing Ceremony.

Owing to the superstitious hold these rites still have upon the people, together with the fact that every initiated person obtained his knowledge at a great expense, it was almost impossible to procure complete texts of any of the ceremonies.

The Tattooing Ceremony is of peculiar interest. It was more difficult to secure information concerning it than of any other ceremony. In earlier times only the warrior who had won war honors was entitled to have the ceremony performed and have the war symbols tattooed upon his body. If his means permitted it, they might also be placed upon any number of his relatives. These war symbols were his marks of distinction as a man of valor, for the strength and life of the tribe depended upon the prowess of the warriors. In those days there were but few who were entitled to have the ceremony performed, because war honors were not easily won and few were wealthy enough to afford the expense of the ceremonies. When, during the last century, wars between the various tribes ceased, the real significance of the rite vanished, but the superstitious belief that the symbolic figures meant long life to the individual so tattooed, remained prominently in the minds of the people.

About the time that the right of the honored warrior to the exclusive use of the Tattooing Ceremonies came to an end, a new condition arose which materially changed the character of the rite. From the sales of lands to the United States the Osage tribe acquired a wealth by which a greater number of its members were enabled to

have performed the tattooing, as well as other ceremonies. It was then that this ancient rite became the means by which any individual could publicly display his affection toward a relative.



FIG 64.—An Osage Indian with tattooing.

Figure 64 shows designs tattooed upon the body of a man. Those on a woman are more elaborate and cover the upper part of her body, breast and back, and the lower part of her legs. Figure 65 shows

three implements used in tattooing. Each of these is made of wood about the length of a pencil. To the lower end are attached needles arranged in a straight row, and to the upper end are fastened four small rattles made of the large wing quills of the pelican. This

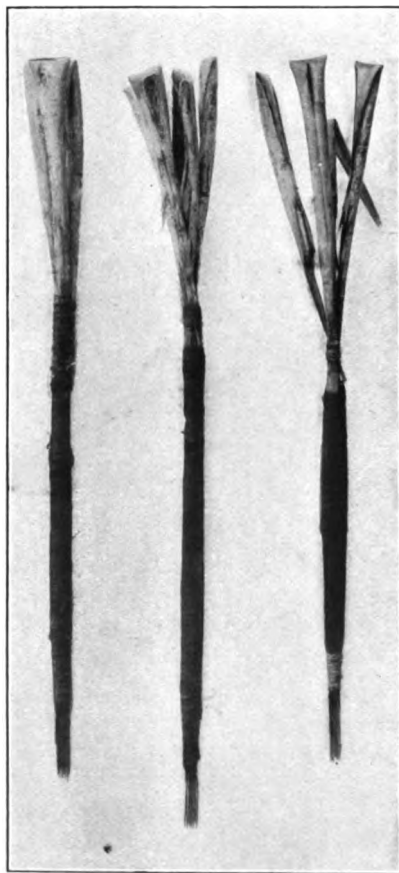


FIG. 65.—Three implements used in Osage tattooing. Photograph by DeLancey Gill.

bird is referred to in one of the dream rituals as, *Mon-thin-the-don-ts'a-ge*, He-who-becomes-very-old-while-yet-going. In certain passages of the ritual it is intimated that these implements were originally made of the wing bone of this bird and were used for doctoring as well as for tattooing.

The coloring matter employed in tattooing is made of charcoal mixed with kettle black and water. The charcoal is made from certain trees that serve as symbols of long life in the war ceremonies. Tail feathers of the pileated woodpecker are used for putting on the ink and drawing the lines.

On November 17, 1910, Wa-çé-ton-zhin-ga, one of the prominent men of the Pa-çi-u-gthin band (Hill-top Dwellers) died. It was learned that he had a Wa-xó-be-ton-ga, a Great Wa-xó-be. This is a white pelican, the bird which is supposed to have revealed, through a dream, the mysteries of tattooing and to have supplied the implements. On February 16, 1911, Wa-çé-ton-zhin-ga's widow after much persuasion reluctantly consented to part with this sacred object (the Great Wa-xó-be), together with its buffalo hair and rush mat cases. It was thus secured by the writer, and now has a place in the United States National Museum.

#### A STUDY OF SIOUX MUSIC

The field-work of Miss Frances Densmore during the season of 1913 was concentrated on the southern portion of the Standing Rock



FIG. 66.—Indians dancing the Grass Dance at Bull Head.  
Photograph by Miss Densmore.

reservation, which lies in the State of South Dakota. Many acquaintances had been made on a previous visit to the locality, and the earlier knowledge gained of the Indians opened the way for intensive work along the lines which had been selected, *i. e.*, songs of war, songs connected with the use of medicinal herbs, and songs of tribal social

organizations. As in previous years, the songs were recorded phonographically, about 130 songs being secured in this manner for the Bureau of American Ethnology.

In connection with this work Miss Densmore collected about 120 specimens, illustrating the old arts and industries as well as the customs of war and the practice of medicine. Twenty herbs said to have medicinal properties were secured from medicine men who use them in treating the sick. These herbs were identified at the Department of Agriculture in Washington, and a number of them were found to be in use among physicians of the white race.



FIG. 67.—Indian equipment for boiling meat without a kettle. Photograph by Miss Densmore.

During the celebration of July Fourth, at Bull Head, many old dances were given. Figure 66 shows the Indians at this celebration of the Grass Dance. A demonstration of the manner of boiling meat without a kettle was also given, Miss Densmore witnessing the process and afterward purchasing the entire equipment, shown in figure 67. This was of interest in connection with the subjects under investigation, as it was a method used in old times by Indians on the war path or buffalo hunt. The paunch of a freshly killed animal was suspended between three stakes, water was placed in it, and brought to the boiling point by means of heated stones. Meat was

thoroughly cooked in this manner. A portion of the meat thus prepared was secured in connection with the apparatus.

Many of the war songs were illustrated by native drawings. Figure 68 shows a man known as Jaw, an old warrior with a wide reputation



FIG. 68.—Jaw, an old Sioux warrior, whose horse-stealing expeditions are illustrated by his own drawings in the background. Photograph by Miss Densmore.

for stealing horses. Behind him is one of his drawings depicting such an expedition.

A medicine man with his drum is shown in figure 69. This man was named White Paw Bear, and proved a valuable informant to Miss

Densmore. He was a close friend of the famous chieftain Sitting Bull.

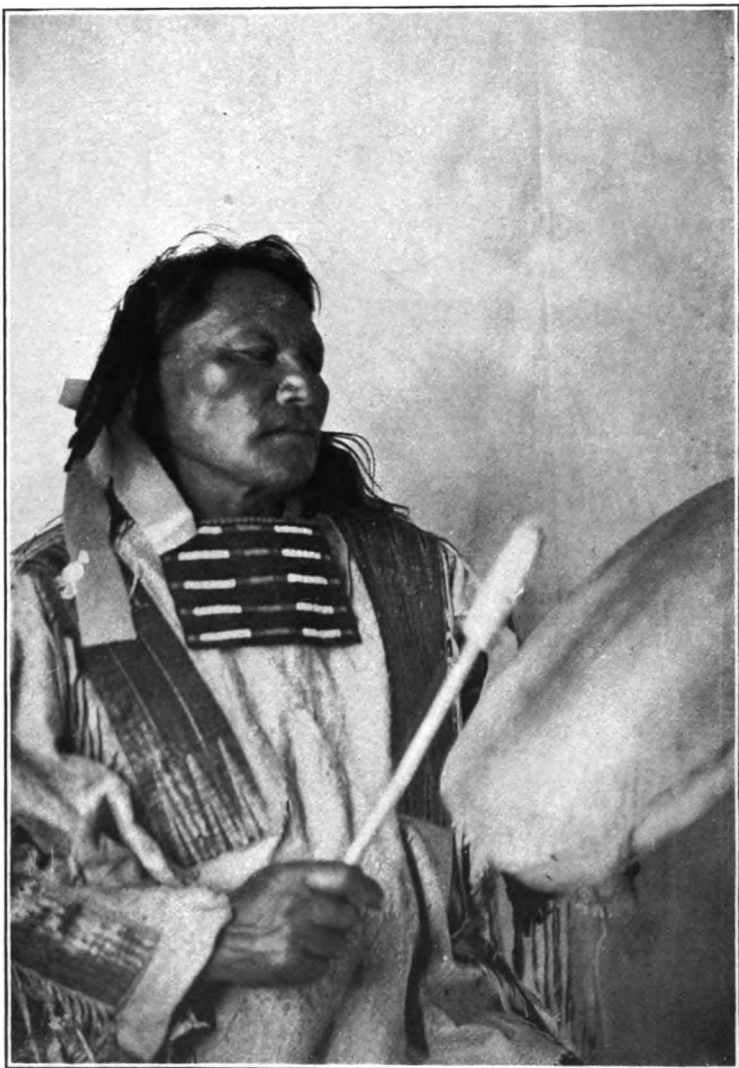


FIG. 69.—White Paw Bear, a medicine man with his drum.  
Photograph by Miss Densmore.

Miss Densmore attended a large feast given in her honor by Red Fox, the Sioux chief who adopted her two years previously in place of his daughter. This adoption was ratified later by the tribe.



## STRANGE RITES OF THE TEWA INDIANS

Mrs. M. C. Stevenson continued her comparative study among the Tewa Indians of the Rio Grande valley, in behalf of the Bureau of American Ethnology. A close relationship was found to exist among all the Pueblo Indians, especially in their essential beliefs, resulting in a great brotherhood between them. Living in an arid land the cry of their souls was and is—"rains to water the earth."

Primitive man sought to define the mysteries of Nature, to account for its phenomena ; thus primitive philosophy was born, and then re-

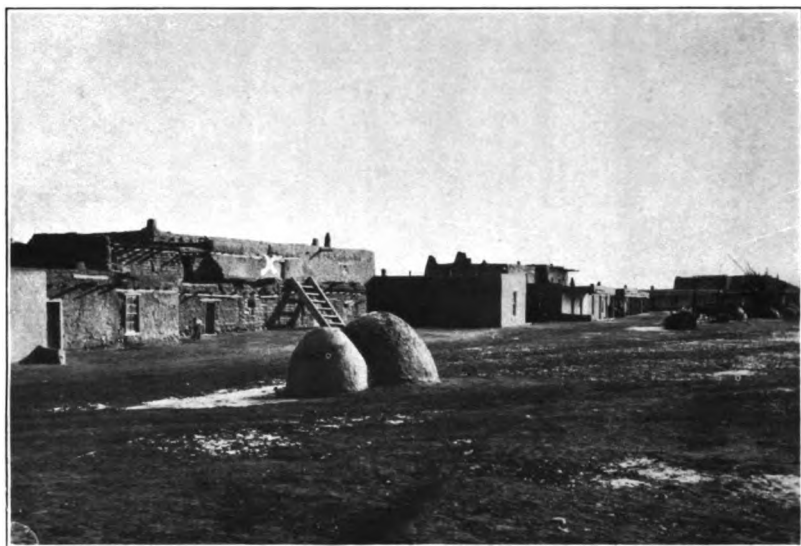


FIG. 70.—Plaza and kiva of the Sun people, San Ildefonso. X denotes the entrance to the kiva. Photograph by Mrs. Stevenson.

ligion and ritualism crept in. The Pueblo Indian began at an early period to create a pantheon of gods of his worship, gods to be appealed to for the good things of life, and angry gods to be propitiated, and thus, long ago, a most complicated system of religion and rituals developed among such peoples of the Southwest as had homes constructed of stone, clay, and plaster.

The more clever men of the past ages differentiated their gods into two classes, anthropic, principally ancestral, and zoöic, and these men assumed to dominate the remainder of the people by asserting their direct communication with the gods. Through their power and influence with these gods they were next in importance to the gods them-

selves. Their doctrines taught that: The gods who bring good are exacting, and man must comply with the demands of his gods in order that the godly blessings may be bestowed upon him. He must not only perform the religious duties assigned him, but observe proper intelligence in the performance of these rites. "In the far past Avä"nyu, the great plumed serpent, whose home is in the depths of the lake of the departed, determined to take a journey over the upper plane so that he could look below and observe the people of this world.

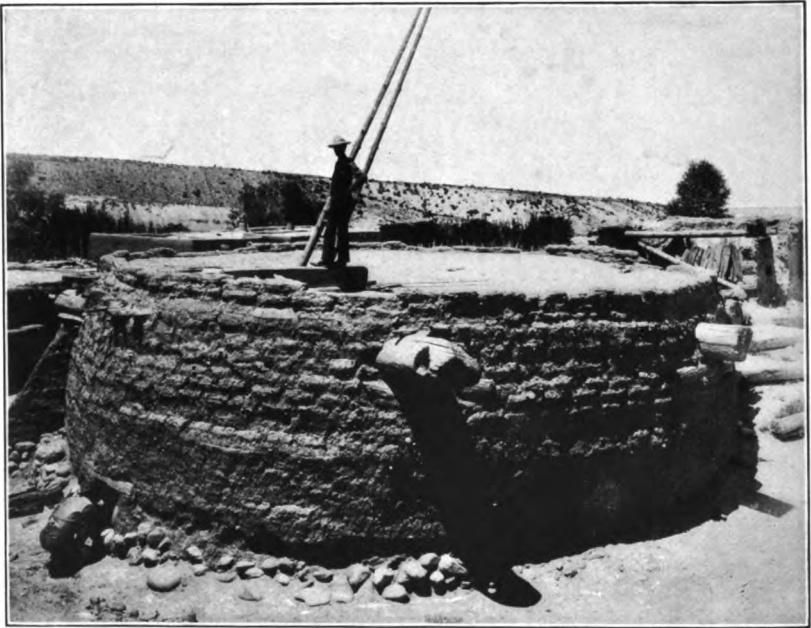


FIG. 71.—Circular kiva at Pueblo of Nambe, New Mexico.  
Photograph by Vroman.

Upon viewing a certain village on the summit of a mesa not many miles from the present pueblo of San Ildefonso on the Rio Grande, he discovered that though the people were devout, their rituals were all wrong and as a punishment for their ignorance he converted them into *sí'de* (small bird), Mexican pajarito, and had them fly away. Since that time the deserted village has been called *Sí'de ge*, small bird place. These ruins are known to the outside world as the Pajarito ruins.

Religion and ritual kept pace with the development of man. The peoples more remote from the long-continued influence of Roman

Catholic priests, retain more of their elaborate rituals and native paraphernalia than those who have been under the control of the Church.



FIG. 72.—Rain priest of Sun people of Nambe. Photograph by Mrs. Stevenson.

Priesthoods and fraternities were organized, and chambers were built in which to invoke and propitiate the gods. These chambers were circular and built under ground, symbolizing the innermost world

whence the people came. As the people ascended from these chambers, they symbolized their emergence from the innermost world



FIG. 73.—Juan Gonzales, associate rain priest, and present governor of San Ildefonso. Photograph by Mrs. Stevenson.

into this world; and, although most of the kivas, or Hopi ceremonial chambers, at the present time, are above ground or partially so, they

still represent the undermost world, the coming out still symbolizing the emergence from the undermost world, and the kiva the undermost world itself. The kiva is a prominent feature of the archeological remains of the Southwest, there is seldom a mesa, cliff, or cavate ruin where these ceremonial chambers are not to be found. They are the substantial evidence of the worship of the cliff dwellers. The underground structures have undergone changes since the oppression of the invading Spaniard. In the Tewa village of San Ildefonso, for example, the under-ground circular kiva was abandoned after the first departure of the Spanish invaders; in fact, there is not a pre-Spanish building in the village. The ruins of the old village are barely distin-

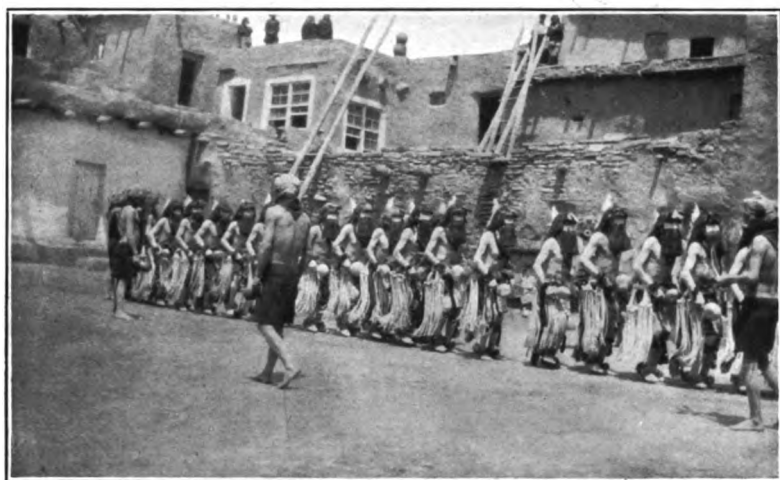


FIG. 74.—Zuñi personators of the rain gods.  
Photograph by Mrs. Stevenson.

guishable in the fields, while the present village stands a short distance to the north. The first kiva constructed by these people after the coming of the Spaniards was round and built principally above ground, but before another kiva was constructed the people decided to build these chambers in rectangular form and in line with their dwellings, so that they would not be distinguished by the Spanish enemy. Many other pueblos adopted the plan of the rectangular kiva situated among the dwelling houses.

The Tewa are divided into the Sun and Ice peoples, therefore there are two kivas, one for each people. Every male child must be initiated into one of the kivas in order to be eligible to dance with the gods after death in the undermost world. The female child is passed

through impressive ceremonies by a priest of the kiva, just after birth, and is carried into the presence of the rising sun on the twelfth day. As the tiny infant is held up facing the sun the following prayer is offered to the Sun father: "May the child grow to womanhood; may she speak with one tongue, be gentle and kind to all, and may all be gentle and kind to her. May her life be so full of love for all the world, and may her acts be so pure that she may be blessed with the love of the Sun father, so that her span of life may be complete, that she may not die, but live long, and become a child again,

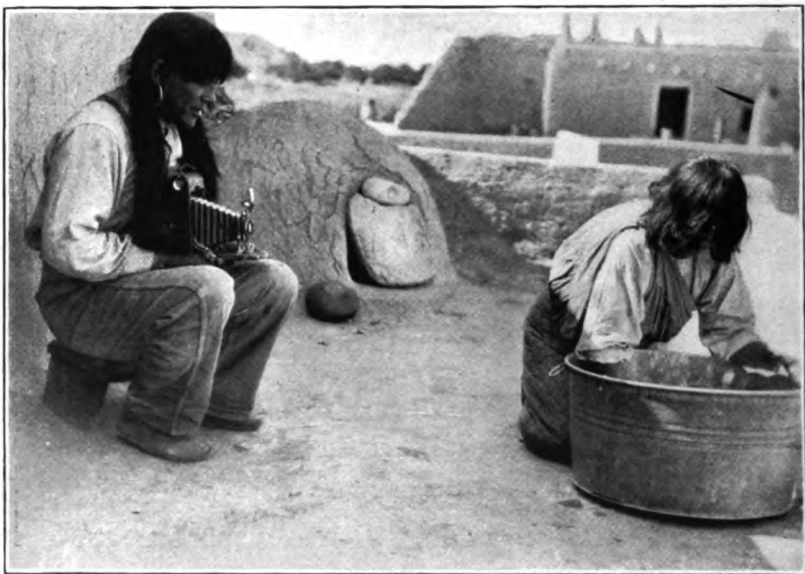


FIG. 75.—Learning to photograph. A fine likeness of the rain priest of the Ice People. The woman at the tub is his mother. Photograph by Mrs. Stevenson.

and so sleep, not die, to awake in the world with the gods. May she ever inhale more of the sacred breath of life."

In order that the rain priest may come into closer communion with the gods he must mortify the flesh. Semi-annually, at the winter and summer solstice, the rain priests of the Sun and Ice people retire, each with his associates, into the kivas for a retreat of four days and nights, to pray for rains, observing strict fasts, taking only meal-bread, and drinking popcorn water. Here it is that the rain gods are specially invoked. The rain priests do not pray with their lips—"hearts speak to hearts." While the priests practice deceptions upon the people and even delude themselves, when they leave their retreat,

it is evident from their expressions that their minds and bodies have been elevated above worldly thoughts.

Whence come the rains so devoutly prayed for? By direction of the Council of the Gods, the shadow people fill their vases and long-necked gourd jugs from the waters of the six regions, and, ascending to the upper plane, provided there are sufficient clouds to protect the rain makers from view of the people of this world, they proceed to water such portions of the earth as have been assigned to them by the Council. The Tewa priests have given such close observation to



FIG. 76.—Kiva of the Ice People, San Ildefonso. X shows upper entrance. Two trees are by the lower entrance. This kiva is headquarters for the buffalo ceremonial. Photograph by Mrs. Stevenson.

the winds and clouds that they are quite weatherwise, and seldom select a time for a rain dance, when rains do not follow.

Zoic worship has to do with the healing of the sick, the beast gods acting as mediators between man and the anthropic gods. The most shocking ceremony associated with the zoic worship of the Tewa is the propitiation of the rattlesnake with human sacrifice to prevent further destruction from the venomous bites of the reptile. The greatest secrecy is observed and the ceremonies are performed without the knowledge of the people except those directly associated with the rite which is performed quadrennially. Although many legends of the various Pueblos have pointed indirectly to human sacrifice in

the past, it was a revelation to Mrs. Stevenson when she was informed that this rite was observed by the Tewa at the present time; and, while it is said to exist only in two of the villages, she has reason to believe that they are not exceptions. In one village the subject is said to be the youngest female infant; in the other village an adult woman is reported to be sacrificed, a woman without husband or children being selected whenever possible. The sacrificial ceremonies occur in the kiva. The subjects are drugged with *Datura meteloides* until life is supposed to be extinct. At the proper time the body is placed upon a sand painting on the floor before the table altar and the ceremony proceeds amid incantations and strange performances.



FIG. 77.—Lucindra Jackson, Yonkalla tribe, Kalapuya family. Photograph from Frachtenberg.

The infant is nude, and the woman is but scantily clad. After the flesh has decomposed and nothing but the bones remain the skeleton is deposited, with offerings, beneath the floor of an adjoining room of the kiva. The entire ceremony is performed with the greatest solemnity.

#### NOTES ON THE ALSEA AND KALAPUYAN INDIANS

The opening of the year found Dr. Leo J. Frachtenberg in Siletz, Oregon, completing the linguistic and ethnological studies that were commenced in 1910 among the Alsea Indians. In addition to im-





FIG. 78.—Mary Harris, who died in 1910, the last of the Willapas. Photograph from Frachtenberg.



FIG. 79.—William Smith, an Alsea Indian, about 65 years of age. Photograph from Frachtenberg.

portant new linguistic material, he obtained a number of myths belonging chiefly to the Coyote cycle. This work was brought to a successful close towards the end of March.

In the early part of June he went to Bay Center, Washington, where he was told could be found, still extant, some members of the Willapa tribe, an important branch of the Pacific group of the



FIG. 80.—William Hartless, a Kalapuya Indian about 65 years of age. Photograph from Frachtenberg.

Athapascan family. Unfortunately, upon close investigation, these reported Willapas proved to belong to the Chehalis tribe of the Salish family, a circumstance that substantiated his previously expressed belief that the Willapa Indians are entirely extinct. Upon his return to Siletz, Oregon, Dr. Frachtenberg began work on the Kalapuyan family, collecting linguistic notes and mythological material until the middle of September, when the work had to be discontinued for lack of funds.

FIELD-WORK AMONG THE CATAWBA, FOX, SUTAIO, AND  
SAUK INDIANS

From a study of Siouan and Muskogean languages, it appeared that these stocks resemble each other morphologically as compared



FIG. 81.—The Brown Family, Catawba Indians. Photograph by Michelson.



FIG. 82.—Catawba Children. Photograph by Michelson.

with other American Indian languages. It therefore became a matter of importance that Catawba, a Siouan language of the Southeast, should be investigated to determine how close these resemblances were, and whether it was possible that both stocks were de-

rived from a common ancestor, but had differentiated at an early date. Accordingly, Dr. Truman Michelson of the Bureau of Ethnology left for South Carolina in May, 1913. Unfortunately, though a goodly number of individual words were collected, it was found that barely half a dozen persons were left who could give simple connected phrases, and only one or two who could give connected



FIG. 83.—An old Cheyenne who remembers a little of the Sutaio language. Photograph by Michelson.

texts, but upon examination it was found that even the few texts which Dr. Michelson collected were extremely fragmentary. Under these conditions it is likely that it will not be possible to unravel the structure of the language in detail, and hence the problems presented above remain unsolved.

In July, Dr. Michelson arrived in Tama, Iowa, to renew his researches among the Fox Indians. After making arrangements for

future work in August, he left for Montana to ascertain whether the Sutaio were a missing link connecting the Cheyenne with the normal Algonquian. The number of persons who remembered anything of the language were few, and none who could dictate connected texts were found. However, it seems clear from the individual words collected, that Sutaio will not shed any light on Cheyenne.



FIG. 84.—David A. Harris, Chief of the Catawba Tribe. Photograph by Michelson.

Upon his return to Iowa at the end of the month, he renewed his work with the Fox Indians. He was particularly successful in working out their social organization. A few more important myths were collected, and a number of those collected previously were translated. During his stay among the Foxes he also secured a number of ethnological specimens for the National Museum.

In October, Dr. Michelson left for Kansas to investigate the Sauk and Fox of the Missouri and adjacent tribes. A preliminary survey was all that was attempted owing to the inclemency of the weather. Some myths, obtained among the Foxes of Iowa, were also translated, and the investigator returned to Washington for office work.



FIG. 85.—A Catawba hearth with pottery. Photograph by Michelson.

#### EXPEDITION OF THE ASTROPHYSICAL OBSERVATORY

Mr. L. B. Aldrich proceeded to Mount Wilson in July, 1913, for the purpose of measuring the solar radiation. He was joined there at the end of August by Director Abbot. Several kinds of work were undertaken; first, the usual spectro-bolometric determination of the solar constant of radiation. This work has now been carried on during every summer at Mount Wilson from 1905 to 1913 inclusive, excepting the year 1907. It has resulted in showing an irregular variability of the sun from day to day, and a dependence of the sun's radiation on the number of sun-spots. It has also yielded a value of the solar constant of radiation believed to be correct within one per cent. Since there have been criticisms of the value, however, on the ground that it is impossible to correctly estimate the losses of radiation in the earth's atmosphere, it was felt desirable to check the result by sending up self-registering apparatus attached to free balloons to the highest possible altitudes.

This work was undertaken by Mr. Aldrich in July in coöperation with the United States Weather Bureau. Balloons were sent up on five days from Santa Catalina Island, carrying in each instance a self-registering pyrheliometer devised and tested at the Smithsonian Astrophysical Observatory, and a self-registering apparatus of the Weather Bureau, which records the temperature, pressure, and humidity of the atmosphere.

All the balloons carrying pyrhelimeters were fortunately recovered, and in one instance the flight reached the altitude of about 33,000 meters, or 108,000 feet. The registering pyrhelimeters behaved very well with the exception that their temperature sunk lower than was expected, so that in each case the mercury in the stem of the



FIG. 80.—Observing station of Astrophysical Observatory on Mount Wilson with new tower telescope. Photograph by Abbott.

thermometers was frozen at an altitude of from 40 to 50 thousand feet, and therefore their records did not extend as high as the flights of the balloons. Nevertheless these measurements are obtained at altitudes above the highest clouds, and where the water-vapor and dust of the atmosphere is almost inappreciable. The results reached do not differ from what would be expected in view of the value of

the intensity of the solar radiation outside the atmosphere, as computed from the ordinary measurements of the Astrophysical Observatory. It is expected that the observations will be repeated with improved apparatus in the year 1914.

After the arrival of Mr. Abbot, the new tower telescope was completed and prepared for observations of the distribution of brightness over the sun's disk. A solar image of about 9 inches in diameter is formed in this telescope by the use of mirrors, without lenses. The distribution of brightness along the diameter of the disk is observed at different colors of light by means of the spectro-bolometer. It is found that the sun is much brighter at the center of the disk than

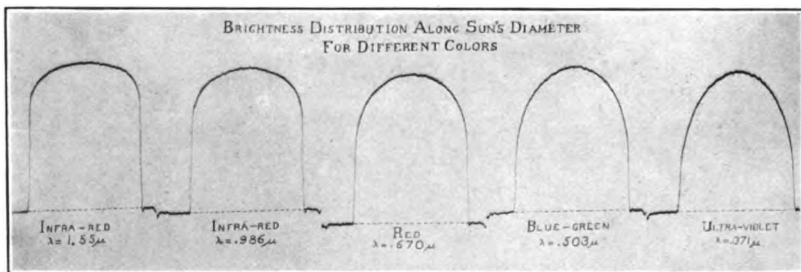


FIG. 87.—Diagram showing Brightness Distribution along Sun's Diameter.

it is near the edge, and that this contrast of brightness is greater for red light than for violet light.

The distribution of brightness along the sun's disk was observed on nearly 50 days, in connection with measurements of the intensity of the solar radiation as it would be outside the atmosphere. The results show in 1913, as in former years, a variability of the solar radiation from day to day. Along with this variability of the amount of the radiation, there is also shown a variability of the distribution of the brightness along the diameter of the sun's disk. This result is very interesting and important, for it enables the variability of the sun to be observed in two independent ways at the same observatory.



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ARCHEOLOGY OF THE LOWER MIMBRES  
VALLEY, NEW MEXICO

(WITH EIGHT PLATES)

BY

J. WALTER FEWKES



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# ARCHEOLOGY OF THE LOWER MIMBRES VALLEY, NEW MEXICO

By J. WALTER FEWKES

(WITH EIGHT PLATES)

## INTRODUCTION

Evidences of the existence of a prehistoric population in the Lower Mimbres Valley, New Mexico, have been accumulating for many years, but there is little definite knowledge of its culture and kinship. It is taken for granted, by some writers, that the ancient people of this valley lived in habitations resembling the well-known terraced dwellings called pueblos, many of which are still inhabited along the Rio Grande; but this theory presupposes that there was a close likeness in the prehistoric architectural remains of northern and southern New Mexico. It may be said that while there were many likenesses in their culture, the prehistoric inhabitants of these two regions possessed striking differences, notably in their architecture, their mortuary customs, and the symbolic ornamentation of their pottery.

As the former inhabitants of the Mimbres Valley have left no known descendants of pure blood, and as there is a scarcity of historical records, we must rely on a study of archeological remains to extend our knowledge of the subject. Much data of this kind has already been lost, for while from time to time numerous instructive relics of this ancient culture have been found, most of these objects have been treated as "curios" and given away to be carried out of the country, and thus lost to science. Some of these relics belong to a type that it is difficult to duplicate. For instance, it is particularly to be regretted that the numerous votive offerings to water gods, including fossil bones, found when the "sacred spring" at Faywood near the Mimbres was cleaned out, have not been studied and described by some competent archeologist. The arrowheads, lance-points, and "cloud-blowers" from this spring are particularly fine examples, the most important objects of the collection being now in the cabinet of Mrs. A. R. Graham of Chicago.<sup>1</sup>

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<sup>1</sup>In a letter to Professor W. H. Holmes, published in his paper, "Flint Implements and Fossil Remains from a Sulphur Spring at Afton, Indian Terri-

The valley of the Mimbres has never been regarded as favorable to archeological studies, but has practically been overlooked, possibly because of the more attractive fields in the regions to the north and west, so that only very meager accounts have been published.<sup>1</sup>

The present article, which is a preliminary report on an archeological excursion into this valley in May and June, 1914, is an effort to add to existing knowledge of the archeology of the valley. During this reconnaissance the author obtained by excavation and purchase a collection of prehistoric objects which have added desirable exhibition material to the collections in the U. S. National Museum.<sup>2</sup>

### HISTORICAL

The recorded history of the inhabitants of the Mimbres is brief. One of the earliest descriptions of the valley, in English, is found in Bartlett's "Personal Narrative," published in 1854. In his account of a trip to the copper mines at the present Santa Rita, Bartlett records seeing a herd of about twenty black-tailed deer, turkeys and other game birds, antelopes, bears, and fine trout in the streams. He

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tory," Mr. A. R. Graham gives an instructive account of cleaning out the Faywood Hot Springs where he found the following relics: (1) parts of skulls and bones of several human beings; (2) over fifty spearheads and arrowheads of every shape and style of workmanship, the spearheads being valuable for their size and symmetry; (3) nine large warclubs made of stone; (4) a large variety of teeth of animals as well as large bones of extinct animals; (5) the most interesting relics are ten stone pipes from four to seven inches in length; (6) flint hatchet and a stone hammer, together with stones worn flat from use; beads made of vegetable seed and bird bones; part of two Indian bows with which was found a quiver in which was quite a bunch of long, coarse black hair that was soon lost after being dried.—*Amer. Anthropol.*, n. s., vol. 4, pp. 126, 127.

<sup>1</sup>The Santa Rita mines early attracted the conquistadors looking for gold, and were worked in ancient times by the Spaniards, the ores obtained finding an outlet along a road down the valley to the city of Chihuahua. The prehistoric people also mined native Mimbres copper, and probably obtained from these mines and from those in Cook's Range, the native copper from which were made the hawk-bells sometimes found in Arizona and New Mexico. From these localities also were derived fragments of float copper often found in Southwestern ruins and commonly ascribed to localities in Mexico. From here came also a form of primitive stone mauls used in early days of the working of the mines.

<sup>2</sup>The National Museum had nothing from the Lower Mimbres before this addition, although it has a few specimens, without zoic designs, from Fort Bayard, in the Upper Mimbres. The latter are figured by Dr. Hough, *Bull.* 87, U. S. National Museum.

says very little, however, about antiquities, although he passed through a region where there are still several mounds indicating ruins. Bartlett writes (*op. cit.*, vol. I, p. 218) :

On April 29, hearing that there were traces of an ancient Indian settlement about half a mile distant, Dr. Webb went over to examine it, while we were getting ready to move. He found a good deal of broken pottery, all of fine texture. Some of it bore traces of red, black, and brown colors. He also found a stone mortar about eight inches in diameter. I have since understood that this was the seat of one of the earliest Spanish missions ; but it was abandoned more than a century ago, and no traces remain but a few heaps of crumbling adobes, which mark the site of its dwellings.

This ruin was situated near the Rio Grande, twenty-three miles from Mule Spring, on the road to the Mimbres. Bartlett does not tell us how he learned that this was an early mission site, but from the pottery it is evident that it was an "ancient Indian settlement."

After having examined the configuration of the country through which Bartlett passed, and having compared it with statements in his description, the present writer thinks that Bartlett camped on May 1, 1853, near the Oldtown ruin and that the place then bore the name Pachetehu. This camp was nineteen [eighteen?] miles from Cow Spring and thirteen miles from the copper mines.

Bartlett records that he found, near his camp, "several old Indian encampments with their wigwams standing and about them fragments of pottery." Although not very definite, these references might apply either to the Oldtown ruin and some others a few miles up the river, or to more modern Apache dwellings.

Mr. F. S. Dellenbaugh claims that Coronado, in 1540, passed through the valley of the Mimbres on his way to Cibola, and that this place was somewhere in this region, instead of at Zuñi, as taught by Bandelier and others. The present writer recognizes that the question of the route of Coronado is one for historical experts to answer, but believes that new facts regarding the ruins in the Mimbres may have a bearing upon this question and are desirable. While it can no longer be said in opposition to Dellenbaugh's theory that there are no ruins in the valley between Deming and the Mexican border, we have not yet been able to discover whether the ruins here described were or were not inhabited in 1540.

The fragmentary notice of the ruins in the Upper Mimbres and Silver City region by Bandelier is one of the best thus far published, although he denies the existence of ruins now known in the great

stretch of desert from Deming to the Mexican boundary. Regarding the ruins on the Upper Mimbres, Bandelier writes:<sup>1</sup>

Toward this center of drainage the aboriginal villages on the Rio Mimbres have gravitated as far south nearly as the flow of water is now permanent. They are very abundant on both sides of the stream, wherever the high overhanging plateaux have left any habitable and tillable space; they do not seem to extend east as far as Cook's Range, but have penetrated into the Sierra Mimbres farther north, as far as twenty miles from the river eastward. . . . The total number of ruins scattered as far north as Hincks' Ranch on a stretch of about thirty miles along the Mimbres in the valley proper, I estimate at about sixty. . . . I have not seen a village whose population I should estimate at over one hundred, and the majority contained ten. They were built of rubble in mud or adobe mortar, the walls usually thin, with overhangs, and a fireplace in the corner, formed by a recess bulging out of a wall. Toward the lower end of the permanent water course, the ruins are said to be somewhat extensive.

Professor U. Francis Duff, in an article on the "Ruins of the Mimbres Valley,"<sup>2</sup> adds a number of new sites to those mentioned above and contributes important additions to our knowledge of the prehistoric culture of the valley.

Dr. Walter Hough, who compiled from Bandelier and Duff, and made use of unpublished information furnished by Professor De Lashmutt and others, enumerates twenty-seven ruins in the Silver City and Mimbres region to which he assigns the numbers 147-174. Many more ruins<sup>3</sup> might have been included in this list, but it is not the author's purpose, at this time, to mention individual pueblo sites but rather to call attention to the evidences of ruins in the Lower Mimbres Valley as an introduction to the study of pottery there collected. The ruin from which the majority of the bowls here considered were obtained does not appear to have been mentioned by Bandelier, Duff, or Hough.

The last-mentioned author makes the following reference to figures on the pottery from the Mimbres region: "The decoration is mainly geometric. From the Mimbres he [Professor De Lashmutt] has seen a realistic design resembling a grasshopper, and from Fort Bayard another representing a four-legged creature. Mrs. Owen has a

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<sup>1</sup> Archæological Institute of America, American Series, vol. 4, Final Report, Part 2, pp. 356, 357.

<sup>2</sup> American Antiquarian, vol. 24, p. 397, 1902.

<sup>3</sup> Bandelier (*op. cit.*, p. 357) speaks of sixty ruins in a small section thirty miles along the river.

specimen from Fort Bayard bearing what is described as a 'fish design.'"<sup>1</sup> Dr. Hough likewise points out that

pottery from some sites [ruins] is also different from that of any other [Pueblo] region and is affiliated, in some respects, with that of the Casas Grandes, in Chihuahua which lies in the low foot-hills of Sierra Madre. This is especially true in reference to fragments of yellow ware found here [the Florida Mountains] which in both form and color of decoration is manifestly like that of Casas Grandes.<sup>2</sup>

The latest and thus far the most important contribution to our knowledge of the prehistoric people of the Mimbres we owe to Mr. C. L. Webster, who has published several articles on the antiquities of the Upper Mimbres, in "The Archæological Bulletin." He has made known several new village sites along the valley and has mentioned, for the first time, details regarding Mimbres ruins and the objects found in them. Practically nothing has thus far been recorded on the antiquities of the region immediately about Deming, nor of those south of that important railroad center to the Mexican border.

In an article on "Some Burial Customs Practiced by the Ancient People of the Southwest,"<sup>3</sup> Mr. Webster describes and figures a human burial on the Lower Mimbres not far from the "Military Post," situated near Oldtown. It was found in the plain some distance from any indications of prehistoric settlement. He says:

An exploration of it [a burial] revealed that originally a circular excavation, perhaps three feet in diameter and slightly more in depth, had been made in the ground; and afterwards the body placed at the bottom of this excavation in a sitting posture with the knees somewhat drawn up and arms to the side, and then a very large earthen olla, of a reddish color, was set over it, bottom side up, thus protecting it from the earth which was afterwards thrown in, filling up the excavation.

Mr. Webster shows that the Mimbres aborigines did not always bury their dead in a contracted or seated posture. He speaks also of intramural or house burials in the valley of Rio Sapillo, a tributary of the Upper Gila, not far from the source of the Mimbres. In this region he dug down in one of the central rooms of a ruin about three feet below the surface, where he says (p. 73):

Near the bottom of this excavation hard red clay was encountered, which on opening up proved to contain the well-preserved skeleton of an adult person

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<sup>1</sup> Bull. 35, Bur. Amer. Ethn., p. 83. See also an article subsequently published on the Culture of the Ancient Pueblos of the Upper Gila River Region, Bull. 87, 1913, U. S. National Museum, in which several bowls with geometrical designs from Fort Bayard are figured.

<sup>2</sup> Bandelier found that Mimbres pottery resembles that of several regions, including Casas Grandes.

<sup>3</sup> The Archæological Bulletin, vol. 3, No. 3, p. 70.

which had been placed at length on its back with arms at its side. Over the face of this one [human burial] had been placed a rather large shallow dish, through the bottom of which a hole about the size of a five cent piece, or a little larger, had been carefully drilled. This hole was so located as to occupy a position between the eyes when placed over the face. This body was resting on a bed of red clay like that which had covered it. Near the first body was a second body which had been buried in exactly the same way, and had a similar perforated dish over its face. Under this first or upper tier of bodies a second tier of bodies was discovered which had been buried exactly the same way as the upper tier—each one resting separate and alone, though near together, each one tightly enveloped in stiff red clay.

All the vessels placed over the faces showed the action of fire, and it was plain to be seen they had once been used in cooking. . . . The method practised here was to first spread down a layer of red plastic clay, then lay the body upon it, place the perforated dish over the face and finally plaster all with a covering of the same clay. This same method was followed in every case observed.

#### SITES OF RUINS IN THE LOWER MIMBRES VALLEY

The portion of the Sierra Madre plateau called Lower Mimbres, or Antelope Valley, extends from where the Mimbres sinks below the surface at Oldtown to Lake Palomas in Mexico, twenty-five miles south of Deming. According to some writers this region has no prehistoric ruins, but several of the beautiful specimens described and figured in the present article came from this valley, and there are doubtless many others, equally instructive, still awaiting the spade of the archeologist. The purest form of the Mimbres prehistoric culture is found in the lower or southern part of this plain, but it extends into the hills far up the Mimbres almost to its source.

The plateau on which the prehistoric Mimbres culture developed is geographically well marked, and distinguished from other regions of the Southwest geographically and biologically, facts reflected in human culture. The cultural gateway is open to migrations from the south rather than from the east, north, or west.

The evidences drawn from the poor preservation of the walls of the ruins, and the paucity of historical references to them, instead of indicating absence of a prehistoric population suggest the existence of a very ancient culture that had been replaced by wandering Apache tribes years before the advent of the Spaniards. Chronologically the prehistoric people belongs to an older epoch than the Pueblo, and its culture resembles that which antedated the true Pueblos.<sup>1</sup>

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<sup>1</sup> During the author's stay in Deming he was much indebted to Dr. S. D. Swope for many kindnesses, among which was an opportunity to study his valuable collection, now in the high school of that city. He was also greatly



The ruins here considered do not belong to the same type as those of the Lower Gila and Salt, although they may be contemporaneous with them, and may have been inhabited at the same time as those on the Casas Grandes River in northern Chihuahua. Not regarded as belonging to the same series of ruins as those on the Upper Gila and Salt rivers, they are not designated numerically with them.

Although the indications of an ancient prehistoric occupancy of the Mimbres are so numerous, they are so indistinct and have been so little studied that any attempt here to include all of them would be premature. Remains of human occupancy occur in the plain about Deming, and can be traced northward along the river east and west into the mountains, and south into Mexico.

The author has observed many evidences of former settlements along the Upper Mimbres which have not yet been recorded. The indications are, as a rule, inconspicuous, appearing on the surface of the ground in the form of rows of stones or bases of house walls, fragments of pottery, and broken stone implements, such as metates and manos. These sites are commonly called "Indian graves," skeletons often having been excavated from the enclosures outlined by former house walls. There are also evidences of prehistoric ditches at certain points along the Mimbres, showing that the ancients irrigated their small farms.

No attempt is made here to consider all the ruins of the Mimbres or of the Antelope plain in the immediate neighborhood of Deming, but only those that have been visited, mainly ruins from which the objects here described were obtained.

Although few of the walls of the ancient buildings rise high above ground, they can be readily traced in several places. From remains that were examined it appears that the walls were sometimes built of stone laid in mortar and plastered on the inside, or of adobe strengthened at the base with stones and supported by logs, a few of which have been found in place upright. No differentiation of sacred and secular rooms was noticed, and no room could be identified as belonging to the type called kiva. The floors of the rooms were made of "caleche," hardened by having been tramped down; the fireplace was placed in one corner, on the floor, and the entrance to the room was probably at one side. To all intents and purposes these dwellings were probably not unlike those fragile wattle-walled structures found

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aided by Mr. E. D. Osborn and several other citizens, and takes this opportunity to thank all who rendered assistance in his studies. The photographs reproduced in the present paper were made by Mr. Osborn.

very generally throughout the prehistoric Southwest, and supposed to antedate the communal dwellings or pueblos of northern New Mexico.

The two aboriginal sites in the Mimbres Valley that have yielded the majority of the specimens here figured and described are the Old-town ruin and the Osborn ruin, a small village site twelve miles south of Deming and four miles west of the Florida Mountains. There are some differences in general appearance and variations in the minor archeological objects from these two localities, but it is supposed that specimens from both indicate a closely related, if not identical, culture area.

About a year ago Mr. E. D. Osborn, of Deming, who had commenced excavation in these ruins,<sup>1</sup> obtained from them a considerable collection of pottery and other objects. His letters on the subject and his photographs of the pottery, sent to the Bureau of American Ethnology, first led the author to visit southern New Mexico to investigate the archeology of the Mimbres.

#### VILLAGE SITE NEAR OSBORN RANCH <sup>2</sup>

A few extracts from Mr. Osborn's letters regarding this site form a fitting introduction to a description of the sites and the objects from them:

At the present time [December 8, 1913] the nearest permanent water to this place [site of the cemetery] is either the Palomas Lake in Mexico, twenty-five miles south, or thirty miles north, where the Mimbres River sinks into the earth. . . . This supposed Pueblo site is situated upon a low sandy ridge which at this point makes a right-angle bend, one part running south and the other west from the angle. The top and sides of the ridge, also the "flat" enclosed between the areas of the ridge, to the extent of about an acre, is littered all over with fragments, charcoal and debris containing bones to the depth of from one to three feet. There are also a great many broken metates and grinding stones. . . . In digging on top of this ridge, near the angle, we occasionally found what appeared to have been adobe wall foundations, but not sufficiently large to determine the size or shape of any building. In digging on the ridge a few stone implements were found, including one fine stone axe, stone paint pots and mortars, and a few arrowheads, also two bone awls and a few shell beads and bracelets, the last all broken. The only article of wood was the stump of a large cedar post full of knots, badly decayed; it had been burned off two or three inches below the surface of the ground. The cemetery was found on the inner slope of the angle facing the southwest. . . . In a

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<sup>1</sup> Specimens were also found by Mr. Osborn at the Byron Ranch ruin, at the Black Mountain site, and elsewhere.

<sup>2</sup> This is the ruin called Osborn ruin in subsequent descriptions.

large proportion of cases the body was placed upon its back, feet drawn up against the body, knees higher than the head; sometimes the head was face up and sometimes it was pressed forward so the top of the head was uppermost. In other interments the body was extended its full length with face up. A large majority of the skulls had a bowl<sup>1</sup> inverted over them, though I judge twenty per cent were without any bowl. . . . In a great many instances after the body had been placed in the grave with bowl over the head, a little soil was filled in, and about one foot of adobe mud was added and tramped down then filled up with soil. This adobe mud is almost like rock, making it difficult to dig up the bowl without smashing it. . . . No article of any kind except the bowl over the head was found in any grave. In one case a bowl was found with a skull under it and under that skull was another bowl and another skull.

Few evidences of upright walls of buildings are found at or near this site. The surface of the ground in places rises into low mounds devoid of bushes, which grow sparingly in the immediate neighborhood, but no trees of any considerable size were noticed in the vicinity. Before work began at this place the only signs of former occupancy by aborigines, besides walls, were a few broken fragments of ancient pottery, metates, or a burnt stump protruding here and there from the ground. None of the house walls projected very high above the surface of the ground. Excavations in the floors of rooms at this point yielded so many human skeletons that the place was commonly referred to as a cemetery, but all indications support the conclusion that it was probably a village site with intramural interments.

The human burials here found had knees flexed or drawn to the breast in the "contracted" position, sometimes with the face turned eastward. The skeletons were sometimes found in shallow graves, but often were buried deeply below the surface. Almost without exception the crania had bowls fitted over them like caps. The graves as a rule are limited to soft ground, the bowls resting on undisturbed sand devoid of human remains. In some instances there appears to have been a hardened crust of clay above the remains, possibly all that is left of the floor of a dwelling. The indications are that here, as elsewhere, the dead were buried under the floors of dwellings, as is commonly the case throughout the Mimbres Valley. While there is not enough of the walls above ground to show the former extent

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<sup>1</sup> On some of the skulls excavated at Sikyatki, Arizona, in 1895, the author found concave disks of kaolin perforated in the center. One of these disks is represented in Fig. 356, p. 729, 17th Ann. Rep. Bur. Amer. Ethnol. In an article on "Urn Burial in the United States" (*Amer. Anthropol.*, vol. 6, No. 5), Mr. Clarence B. Moore, quoting his own observations and those of many others, records burials in which an inverted mortar, bowl, basket, or other object was placed over the skull of the dead, and shows the wide distribution of the custom.

of the dwellings, the indications are that they were extensive and have been broken down and washed away.

#### OLDTOWN RUIN

Near where the Mimbres leaves the hills and, after spreading out, is lost in the sand, there was formerly a "station," on the mail route, called Mimbres, but now known as Oldtown. Since the founding of Deming, the railroad center, the stage route has been abandoned and Mimbres (Oldtown) has so declined in population that nothing remains of this settlement except a ranch-house, a school-house, and a number of deserted adobe dwellings.

Oldtown lies on the border of what must formerly have been a lake and later became a morass or cienega, but is now a level plain lined on one side with trees and covered with grass, affording excellent pasturage. From this point the water of the Mimbres River is lost, and its bed is but a dry channel or arroyo which meanders through the plain, filled with water only part of the year. In the dry months the river sinks below the surface of the plain near Oldtown reappearing at times where the subsoil comes to the surface, and at last forms Palomas Lake in northern Mexico.

In June, when the author visited Oldtown, the dry bed of the Mimbres throughout its course could be readily traced by a line of green vegetation along the whole length of the plain from the Oldtown site to the Florida Mountains.<sup>1</sup>

The locality of emergence of the Mimbres from the hills or where its waters sink below the surface is characteristic. The place is surrounded by low hills forming on the south a precipitous cliff, eighty feet high, which the prehistoric inhabitants chose as a site of one of their villages; from the character and abundance of pottery found, there is every reason to suppose this was an important village.

The Oldtown ruin is one of the most extensive seen by the author during his reconnoissance in the Deming Valley, although not so large as some of those in the Upper Mimbres, or on Whiskey Creek, near Central. Although it is quite difficult to determine the details of the general plan, the outlines of former rectangular rooms are indicated by stone walls that may be fairly well traced. There seem to have been several clusters of rooms arranged in rows, separated by square or rectangular plazas, unconnected, often with circular depressions between them.

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<sup>1</sup> A beautiful view of the valley can be obtained from the top of Black Mountain, above the small ruin at its base, that will be mentioned presently.

There is considerable evidence of "pottery hunting" by amateurs in the mounds of Oldtown, and it is said that several highly decorated food bowls adorned with zoic figures have been taken from the rooms. It appears that the ancient inhabitants here, as elsewhere, practised house burial and that they deposited their dead in the contracted position, placing bowls over the crania (fig. 1).<sup>1</sup>

The author excavated several buried skeletons from a rectangular area situated about the middle of the Oldtown ruin, surrounded on three sides by walls. The majority of the dead were accompanied

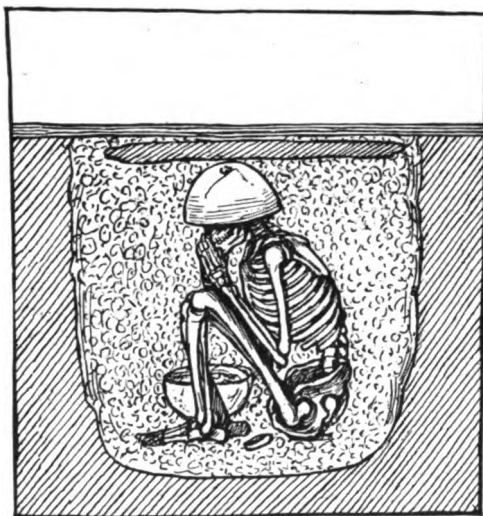


FIG. 1.—Urn burial. (Schematic.)

with shell beads and a few turquoise ornaments, and on one was found a number of shell tinklers made of the spires of seashells. One of the skeletons excavated by Mr. Osborn appeared to have been enclosed in a stone cist with a flat slab of stone covering the skull. The remains of a corner post supporting the building stood upright on this slab.<sup>2</sup> In another case a skull was found broken into fragments by the large stone that had covered it. Several skeletons had no bowls

<sup>1</sup> The drawings of pottery designs in this article were made by Mrs. M. W. Gill; the stone and other objects were drawn by Mr. R. Weber.

<sup>2</sup> A significant feature in the Mimbres form of "urn burial" is the invariable puncturing of the bowl inverted over the head. The ancient Peruvians in some instances appear to have "killed" their mortuary bowls, and life figures depicted on Peruvian pottery are sometimes arranged in pairs as in the Mimbres.

over the heads, an exceptional feature in Mimbres burials; and in some instances the bowl had been placed over the face. In the case of numerous infant interments the bowl covered the whole skeleton.

#### RUIN ON BYRON RANCH

This ruin lies not far from the present course of the Mimbres near the Little Florida Mountains. The place has long been known as an aboriginal village site and considered one of the most important in the valley. The remains of buildings cover a considerable area. They have a rudely quadrangular form, showing here and there depressions and lines of stones, evidently indicating foundations of rooms, slightly protruding from the ground. Although this ruin has been extensively dug over by those in search of relics, no systematic excavations seem to have been attempted. It is said that valuable specimens have been obtained here, and fragments of pottery, arrowheads, and broken stone implements are still picked up on the surface.

The important discovery of burial customs of the ancient Mimbresños was made by Mr. Duff at this ruin. He excavated below the floor of one of the rooms and found a human cranium on which was inverted a food bowl pierced in the middle, the first example of this custom noted in the Mimbres region.

#### RUIN NEAR DEMING

About seven miles northwest of Deming, in a field on the north side of the Southern Pacific Railroad, there is a small tract of land



FIG. 2.—Paint mortar. Diam.  $2\frac{1}{2}$ ".

showing aboriginal artifacts strewn over the surface, affording good evidence of prehistoric occupation. There are no house walls visible at this place, and only a few fragments of food bowls, but in the course of an hour's search several small mortars (fig. 2), paint grinders and other objects were procured at this place.<sup>1</sup>

<sup>1</sup> Although not placed in the proper locality on his map, this ruin seems to be one of the "pueblos" (Nos. 162-164) mentioned by Dr. Hough.

## PREHISTORIC SITE NEAR BLACK MOUNTAIN

Walls and outlines of rooms indicated by rows of stones mark remains of a prehistoric settlement at the base of Black Mountain, eight or nine miles northwest from Deming. Here occur many fragments of pottery, broken metates, and manos, and other indications of occupation by man. On top of Black Mountain there are rude cairns or rings of stones apparently placed there by human hands.

The fragments of pottery taken from the ruin at the base of Black Mountain are very different from those from Oldtown and other typical Mimbres ruins. Its color on the outside is red, with a white interior surface decorated with black geometric designs, the border is flaring often with exceptional exterior decoration. These bowls have broken encircling lines—a feature yet to be found in other Mimbres pottery—and none of the few pieces yet obtained from the ruin near Black Mountain has animal pictures. The whole appearance of this pottery recalls old Gila ware and suggests an intrusion from without the Mimbres region, possibly from the north and west.

The circles of stones on the top of Black Mountain have many points of resemblance to similar structures on hilltops near Swarts' Ranch on the Upper Mimbres, described by Mr. Webster, as follows:<sup>1</sup>

The tops of nearly all the mountains of this valley, and particularly those here mapped, are occupied by hundreds of rock mounds, breastworks, pits, etc. The region shown in plate 3, and which represents an area about one mile in length and three-fourths mile in width, exhibits 240 of these structures. . . . These rock mounds are composed of more or less rounded rocks gathered from the region, and generally weighing from four to eight pounds each; although many are smaller: and again others weigh from twenty-five to fifty pounds or more each. These structures are generally circular: although at times they are ovate, and again assume an oblong or linear marginal outline. They vary considerably in size, although usually being only from three to four feet in diameter: the linear ones being from six to eight feet or more in length. Some of the larger circular mounds assume a diameter of seven to eight feet. The height of these mounds varies considerably; but as a rule assume a height ranging from one to one and a half feet.

The distance apart of these structures is variable; being as a general thing from five to fifteen feet; but not infrequently they are only two to four feet apart: at other times, however, they may be observed to be from sixty to ninety feet or more distant from each other.

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<sup>1</sup> Archaeological and Ethnological Researches in Southwestern New Mexico, Part 2, Ruin, Ancient Work Shop, Rock Mounds, etc., at Swarts' Ranch. (The Archaeological Bulletin, vol. 4, No. 1, p. 14, 1913.)

Mr. Webster discovered on a rocky ridge near Swarts' ruin, somewhat higher on the Mimbres than Brockman's Mill, seven similar earthen pits of much interest, which remind the author of subterranean or half-sunken dwellings. They are saucer-shaped or linear depressions, averaging about two feet in depth; when circular they are from five to fifteen feet in diameter the linear form in one instance being fifty feet long. Some of these have elevated margins, others with scarcely any marginal ridge. The western margin in one instance has a "wall of rounded stones."

There are similar saucer-shaped depressions near Brockman's Mills and elsewhere in the Mimbres, almost identical with "pit dwellings" found by Dr. Hough near Los Lentos. These saucer-like depressions, often supposed to have been the pits from which adobe was dug, were also places of burial, the dead being presumably interred under or on the floors; the original excavation being a dwelling that was afterwards used as a burial place for the dead. Their form suggests the circular kiva of the Pueblos and has been so interpreted by some persons.

#### RUINS ON THE MIMBRES RIVER FROM OLDTOWN TO BROCKMAN'S MILLS

On low terraces elevated somewhat above the banks of the river, between Oldtown and Brockman's Mills, there are several village sites, especially on the western side.<sup>1</sup> The most important of these is situated about four miles north of Oldtown. The ruin at the Allison Ranch, situated at the Point of Rocks where the cliffs come down to the river banks, is large and there are many pictographs nearby. The ruins at Brockman's Mills on the opposite or eastern side of the river lie near the ranch-house. Many rooms, some of which seem to have walls well plastered, can be seen just behind the corral. North of the ruin is a hill with low lines of walls like trincheras. On some of the stones composing these walls and on neighboring scattered boulders, there are well-made pictographs.<sup>2</sup>

#### PICTOGRAPHS

Pictographs occur at several localities along the Mimbres. As these have a general likeness to each other and differ from those of other regions, they are supposed to be characteristic of the prehistoric

<sup>1</sup> For a description of ruins at Swarts' and Brockman's Mills see C. L. Webster, *Archæological and Ethnological Researches in Southwestern New Mexico*. (The *Archæological Bulletin*, vol. 3, No. 4.)

<sup>2</sup> It is said that a Spanish bell in the Chamber of Commerce at Deming, was dug up on this ranch near the ruin. This bell might indicate an old mission at this place.



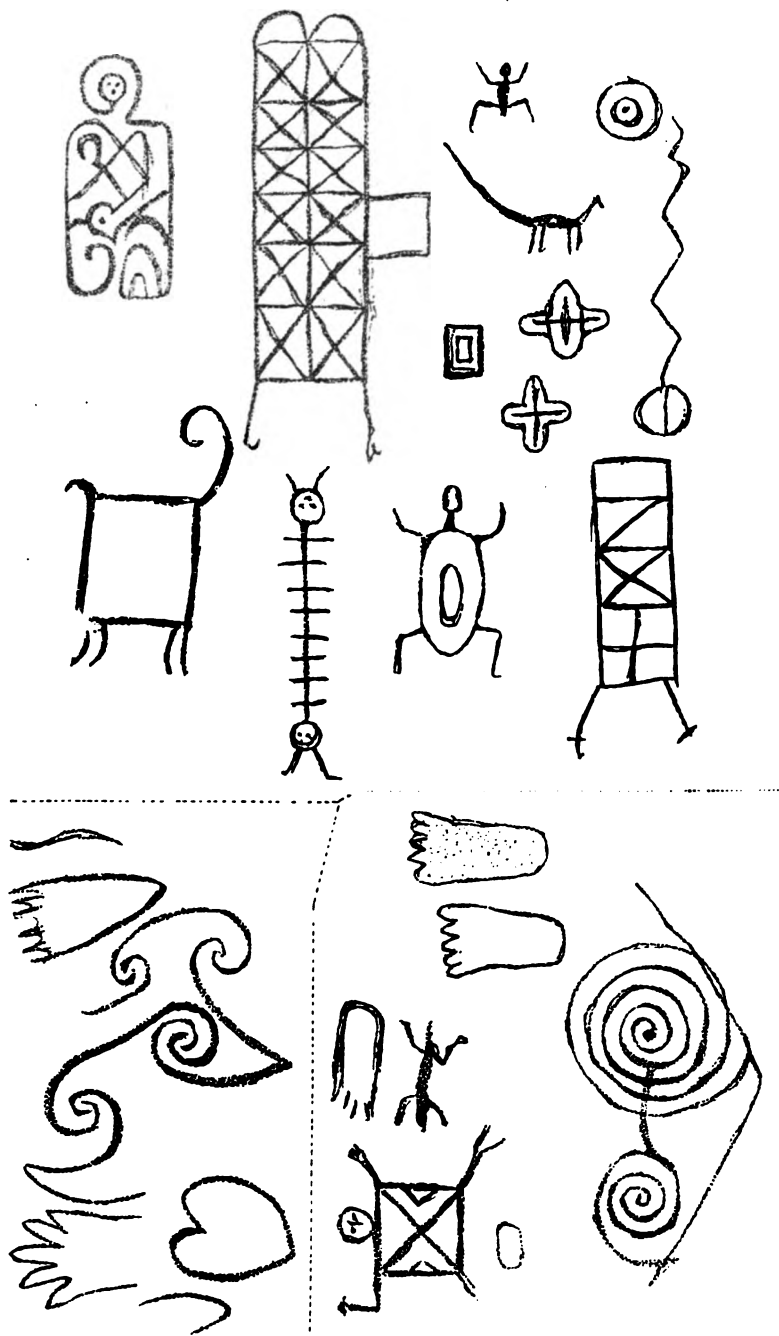


FIG. 3.—Pictographs.

people. They are generally pecked on the sides of boulders or on the face of the cliffs in the neighborhood of prehistoric sites of dwellings. Although there is only a remote likeness between these pictographs and figures on pottery, several animal forms are common to the two.

The most important group of pictographs (fig. 3) seen by the author are situated about nine miles from Deming in the western foot-hills of Cook's Peak.<sup>1</sup> Some of the pictographs recall decorations on bowls from Pajarito Park.

Another large collection of Mimbres pictographs, visited by the author, is found at Rock Canyon, three or four miles above Oldtown, at a point where the cliffs approach the western bank of the river. On the river terrace not far above this collection of pictures, also on the right bank of the river, lies the extensive ruin of a prehistoric settlement, the walls of which project slightly above the surface. This ruin has been dug into at several points revealing several fine pieces of pottery, fragments of metates, and other implements, which are said to have been found in the rooms. A mile down the valley overlooking the river there is another cluster of pictures at a ruin called "Indian graveyard," probably because human skeletons have been dug out of the floors of rooms.

#### MORTARS IN ROCK IN PLACE

One of the characteristic features of the Mimbres ruins, but not peculiar to them, are mortars or circular depressions worn in the horizontal surface of rock in place. They are commonly supposed to have been used as mortars for pounding corn, and vary in size from two inches to a foot in diameter, being generally a foot deep. We find them occurring alone or in clusters. Good examples of such depressions are found near the Byron ruin, in the neighborhood of the ruins along Whiskey Creek, at Oldtown, and elsewhere. There is a fine cluster of these mortars nine miles from Deming, near the pictographs in the Cook's Range. Similar mortars have been repeatedly described and often figured. Mr. Webster has given the most complete account of this type of mortars in a description of the ancient ruins near Cook's Peak.<sup>2</sup> On the surface of the southwestern

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<sup>1</sup> The author visited these rocks in company with Dr. Swope, who has known of them for many years.

<sup>2</sup> *Archæological and Ethnological Researches in Southwestern New Mexico*, Part 4. (*The Archæological Bulletin*, vol. 5, No. 2, p. 21.)

point of a low hill to the north of an ancient ruin at Cook's Peak, according to this observer,

occurs a feature which the writer had nowhere else seen, save on the east side of the same mountain. I refer to the great number of mortars which occur in this sandstone back a few feet to the north of the ruins, and which were made and long used by the ancient pueblo-dwellers. There exists at this one place fifty-three of these mortars, nearly all of them occurring in an area of surface not more than seventy-five or eighty feet in diameter. . . . Nearly all the mortars are circular or sub-circular in outline, symmetrical and smooth inside, and the upper edge or margin usually rounded by the pestle. In a few cases, however, these mortars have an oblong or subovate outline, somewhat like some forms of metates found among the ruins.

These mortars often contract to a point at the bottom, when circular in marginal outline, although at times are longer than broad, as just stated, and in this case have a more flattened bottom. They vary from two to eleven inches in diameter, the smallest forms being those apparently only just begun, and are few in number. The deepest mortar observed was seventeen inches, though the great majority of them would vary perhaps from four to ten inches in depth. Often the rock was smooth and polished around the margin of the mortars, and [their distances apart] vary from a few inches to several feet from each other.

At times these mortars would be located on the top of a large block of sandstone which might happen to occupy this area; these boulders sometimes being four to five feet in diameter and perhaps four feet in height. It was plain to be seen that this ancient mill-site was long used by these peculiar people, but just why so many quite similar mortars should have been made here and used by these people is a matter of conjecture.

It seems certain that a sufficiently large number of people could not have been congregated here, under ordinary conditions, to warrant the forming of so many mortars for the purpose of grinding food.<sup>1</sup>

The present writer accepts the theory that these rock depressions were used in pounding corn or other seeds, but their great number in localities where ruins are insignificant or wanting is suggestive. We constantly find arable land near them, indicating that communal grinding may have been practised, and suggesting a large population living in their immediate neighborhood, which may have left no other sign of their presence.

#### MINOR ANTIQUITIES

The artifacts picked up on the surface near ruins or excavated from village sites resemble so closely those from other regions of the Southwest that taken alone these do not necessarily indicate special

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<sup>1</sup> Mr. Webster describes "ancient pueblos" on the western side of this group of mountains as well as on the eastern slope of Cook's Range. Certain cave lodges, or walled caves, in a wild canyon on the east side of Cook's Peak are supposed by him to be the recent work of Apaches.

culture areas. A few of the more common forms from the Mimbres are here figured for comparison, but, with the exception of the pottery, there is little individuality shown in the majority of these objects. Among other objects may be mentioned stone implements, mortars, idols, bone implements, shell ornaments, and pottery.

#### STONE IMPLEMENTS

The stone axes are not very different from those of the Rio Grande and the Gila, but it is to be noticed that they are not so numerous as in

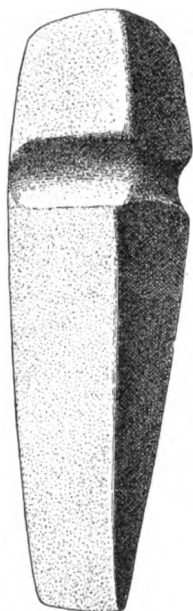


FIG. 4.—Stone axe.  
Length  $8\frac{3}{4}$ ".

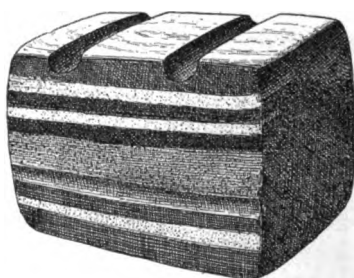


FIG. 5.—Arrow polisher. Length  $3\frac{3}{4}$ ",  
breadth  $2\frac{1}{2}$ ".

the latter region, and are probably inferior in workmanship, fine specimens indeed being rare. The majority of the axes (fig. 4) are single grooved, but a few have two grooves. In Dr. Swope's collection, now in the Deming High School, there is a fairly good double-bladed axe.

Miss Alnutt, of Deming, has a remarkable collection of arrow-points gathered from many localities in the valley, and also a few fine spearpoints, conical pipes, and other objects taken from the sacred spring at Faywood Hot Spring. A beautiful arrow polisher found near Deming is shown in figure 5.

The pipes from the Mimbres take the form of tubular cloud-blowers, specimens of which are shown in figure 6. Apparently these pipes were sometimes thrown into sacred springs, but others have been picked up on the surface of village sites or a few feet below the surface.

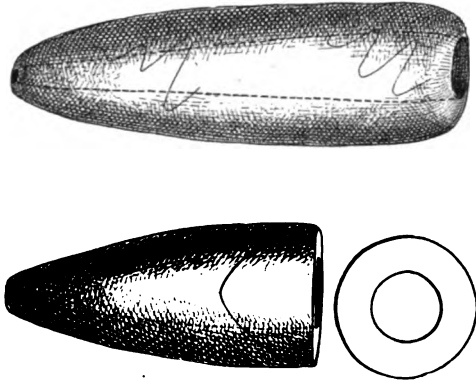


FIG. 6.—Cloud blowers. Faywood Hot Springs. (Swope collection.)  
 $\frac{1}{2}$  nat. size.

Lateral and top views of one of the characteristic forms of small stone mortars with a handled projection on one side is shown in figure 7. This specimen is in the Swope collection in the Deming

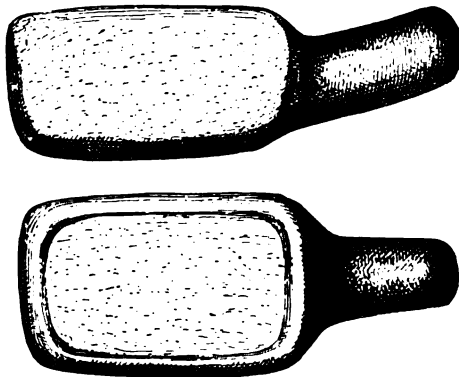


FIG. 7.—Handled mortar. (Swope collection.) Length  $10\frac{1}{4}$ ".

High School. In the same collection there are also two beautiful tubular pipes, or cloud-blowers, from the same spring.

The stone mortars from Mimbres ruins vary in size. Many are simply spherical stones with a depression on one side; others are larger but still spherical, or ovate; while others have square or

rectangular forms. The most remarkable feature in these is the presence of a handle on one side, which occasionally is duplicated, and in one instance four knobs or legs project from the periphery. These projections appear to characterize the mortars of the Mimbres, although they are not confined to them, as the form occurs in other regions of New Mexico and in California. One of the most instructive of these small spherical paint mortars, now owned by Mr. E. D. Osborn, has ridges cut in high relief on the outside.

Metates and manos, some broken, others whole, are numerous and can be picked up on almost every prehistoric site. While some of these metates are deeply worn, showing long usage, others have margins but slightly raised above the surface. The majority of metates found on the sites of habitations have no legs, but a typical Mexican metate with three knobs in the form of legs was presented to the National Museum by the Rev. E. S. Morgan, of Deming. Metates are sometimes found in graves with skeletons, presumably those of women. Several ancient metates are now in use as household implements in Mexican dwellings.

If the size of the population were to be gauged by the number of mortars and manos found, certainly the abundance of these implements would show that many people once inhabited the plain through which flows the Mimbres River. Narrow, flat stone slabs have an incised margin on one end. Their use is problematical. The frequency of stone balls suggests games, but these may have been used as weapons; or again, they were possibly used in foot races, as by the Hopi of to-day.

#### COPPER OBJECTS

Native metallic copper was formerly abundant at the Santa Rita mines, and there is every probability that the material out of which some of the aboriginal copper bells were made was found here, and that these mines were the source of float copper found in Arizona ruins. Although no copper implements were found by the author in the Mimbres ruins, he has been told that objects of copper apparently made by the aborigines have been found in some of the graves.<sup>1</sup>

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<sup>1</sup> Elaborate metal objects of early historical times have been found at various places in the Mimbres. The best of these is a fragment of an elaborately decorated stirrup, now owned by Mr. Pryor of the Nan Ranch. A copper church bell was found near his house, and other metal objects belonging to the historic epoch are reported from various ruins in the valley.

## STONE IDOLS

The author saw several stone idols that were reported to have been obtained from ruins in the Mimbres Valley. These idols represent frogs (fig. 8), bears, mountain lions, and other quadrupeds, and have much the same form as those from ancient ruins in Arizona.<sup>1</sup>

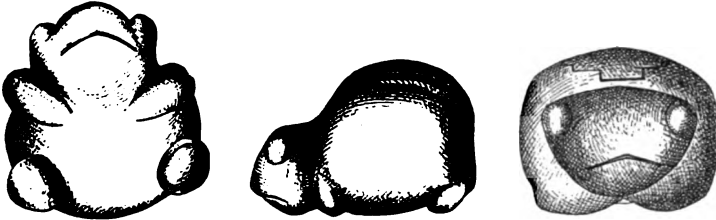


FIG. 8.—Frog fetish. Black Mountain Ruin. (Swope collection.) Length  $3\frac{1}{2}$ ".

On the backs of several of these stone idols are incised figures, like arrowheads tied to Zuñi fetishes, or possibly rain-cloud figures. In one instance they were made on an elevated ridge, which unfortunately was broken. The author has also seen several small amulets,

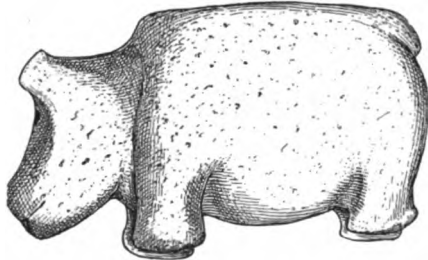


FIG. 9.—Fetish. Byron Ranch. (Swope collection.) Length  $5\frac{3}{4}$ ".

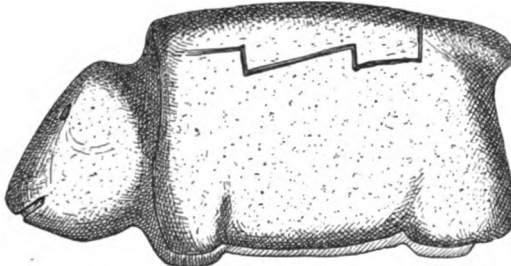


FIG. 10.—Fetish. Byron Ranch. (Swope collection.) Length  $6\frac{3}{4}$ ".

perforated apparently for suspension. The stone idols here figured (figs. 8, 9, 10) were presented to the Deming High School by Dr. Swope.

<sup>1</sup> Similar stone idols from the San Pedro Valley and other localities, in Arizona and New Mexico, have mortar-like depressions on their backs.

## SHELL BRACELETS AND CARVED SHELLS

Two or three shell bracelets were excavated from Mimbres ruins, and there were also found carved shells and tinklers not unlike those of northern New Mexico ruins. Some of these when excavated were found near the head and are supposed to have been earrings. Five shell rings were still on the bones of the forearm of a child when found. One of the shell bracelets owned by Mr. Osborn was cracked but was pierced on each side of the break, indicating where it had been mended; another had figures incised on its surface, and a third had the edges notched, imparting to it a zigzag shape, like that of a serpent. Many shell beads, spires of shells used for tinklers, and other shell objects, all made of genera peculiar to the Pacific Ocean, were found during the excavations.

## POTTERY

## FORMS AND COLORS

The comparatively large number of vases, food bowls, and other forms of decorated smooth ware in collections from the Mimbres is



FIG. 11.—Braided handle.  
 $\frac{1}{2}$  nat. size.



FIG. 12.—Small bowl.  
Diam.  $3\frac{1}{2}$ ".

largely due to their use in mortuary customs, and the fact that almost without exception they were found placed over the skulls of the dead. Although the largest number of vessels are food bowls, there are also cups with twisted handles (fig. 11), bowls (fig. 12), vases, dippers, and other ceramic forms found in pueblo ruins.<sup>1</sup>

Coarse, undecorated vessels showing coils, indentations, superficial protuberances, and other rude decorations like those so well known in Southwestern ruins, are well represented. Some of these were

<sup>1</sup> One of the exceptional forms of pottery has a flat rectangular base, the four sides being formed by bending up segments of a circular disk (fig. 18).



used as cooking vessels, as shown by the soot still adhering to their outer surface. While the majority of bowls were broken in fragments when found, a few were simply pierced through the bottom; one or two were unbroken or simply notched at the edge.

The colors of Mimbres ware are uniform and often striking. There are good specimens of black and white ware; also red, black, and yellow with brown decorations are numerous. Some of the best pieces are colored a light orange. Many of the fragments are made of the finest paste identical in color and finish with ware from Casas Grandes, Chihuahua, which furnishes the best prehistoric pottery from the Southwest. No effigy jar, or animal formed vase, however, exists in any collections from the Mimbres examined by the author.

Ruins in the Lower Mimbres have thus far yielded a larger variety and a finer type of pottery than ruins on the banks of the river among the hills, which is in part due to the extent of excavations. The Old-town potters developed a kind of pottery with characteristic ornamentation found both in ruins in the plain to the south and along the narrow valley of the Mimbres to the north.

The Mimbres pottery, like all other ancient ware from the Southwest, frequently shows evidences of having been mended. Holes were drilled near the breaks and fibers formerly united the parts thus holding the bowl together even though broken. As one goes south, following the course of the river, the character of the pottery changes very slightly, but if anything is a little better.

The food bowls generally have a rounded base, but one specimen is flat on the bottom. The edges of the bowls from the ruin at Black Mountain are curved outward, an exceptional feature in ancient Pueblo vessels but common in modern forms.

#### PICTURES ON MIMBRES POTTERY

The great value of the ceramic collection obtained from the Mimbres is the large number of figures representing men, animals, and characteristic geometrical designs, often highly conventionalized, depicted on their interiors. These figures sometimes cover a greater part of the inner surface, are often duplicated, and are commonly surrounded by geometrical designs or simple lines parallel with the outer rim of the vessel. It is important to notice the graceful way in which geometrical figures with which the ancient potters decorated their bowls are made to grade into the bodies of animals, as when animal figures become highly conventionalized into geometrical designs. Although these decorations are, as a rule, inferior to

those of the Hopi ruin, Sikyatki, the figures of animals are more numerous, varied, and realistic.

The ancients represented on their food bowls men engaged in various occupations, such as hunting or ceremonial dances, and in that way have bequeathed to us a knowledge of their dress, their way of arranging their hair, weapons, and other objects adopted on such occasions. They have figured many animals accompanied by conventional figures which have an intimate relation to their cults and their social organization. Although limited in amount and imperfect in its teaching this material is most instructive.

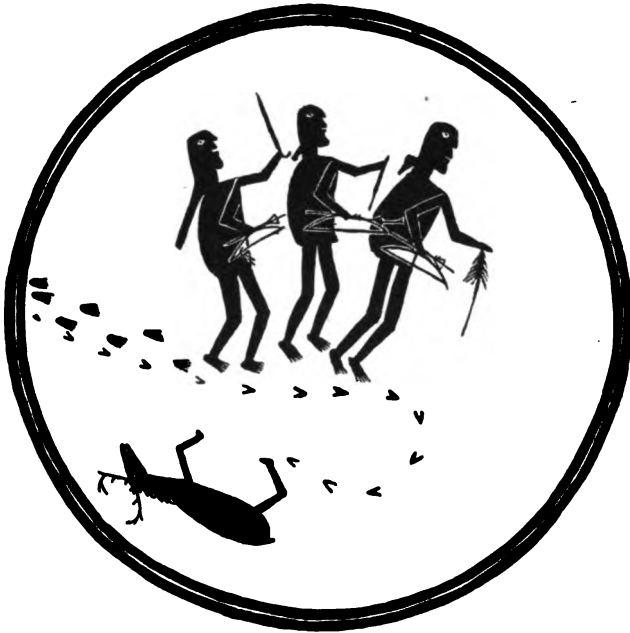


FIG. 13.—Hunters. Oldtown Ruin. (Osborn collection.)

#### GROUP OF HUNTERS

An instructive group of human figures is drawn on a deep red and white food bowl (fig. 13), which measures ten inches in diameter. It is evident that this design represents three hunters following the trail of a horned animal, probably a deer. This trail is represented on the surface of the bowl by a row of triangles, while the footprints of the hunters extend along its side. It may be noted that although there are three hunters, the trails of two only are represented, and that the hunters are barefoot. They have perhaps lost the trail and

are looking the opposite way, while the animal has turned back on his path. The footprints of the deer in advance of the hunters are tortuous, showing want of decision on the part of the animal. The three hunters are dressed alike, wearing the close-fitting jacket probably made of strips of skin woven together like that found by Dr. Hough in a sacrificial cave at the head of the Tulerosa, New Mexico. Each carries a bow and arrow in his right hand, and in his left a stick which the leader uses as a cane; the second hunter holds it by one end before him, and the third raises it aloft. These objects are supposed to represent either weapons or certain problematic wooden staffs with feathers attached, like divining rods, by which the hunters are in a magical way directed in their search. The first hunter "feels" for the lost trail by means of this rod.

An examination of the pictures of the arrows these hunters carry shows that each has a triangular appendage at the end representing feathers, and small objects, also feathers, tied to its very extremity. The hair of the third hunter appears to be a single coil hanging down the back, but in the other two it is tied in a cue at the back of the head. The eyes are drawn like the eyes on Egyptian paintings, that is, the eye as it appears in a front view is shown on the side of the head. The right shoulders of all are thrown out of position, in this feature recalling primitive perspective. The information conveyed by this prehistoric picture conforms with what is known from historical sources that the Mimbres Valley formerly abounded in antelopes, and we have here a representation of an aboriginal hunt.

#### FIGURE OF A WOMAN

A black and white bowl (pl. I, fig. 1) is twelve and one-half inches in diameter and six inches deep. Upon this bowl is drawn a figure of a human being, probably a woman or a girl, seen from the front. Although portions of the figure are not very legible, such details as can be made out show a person wearing a blanket that extends almost to the knees leaving arms and legs bare, the lower limbs being covered. The head is square, as if masked, with hair tied at each lower corner. Although these appendages may be meant to represent ear-pendants, it is more likely that they are whorls of hair, as is still customary in Pueblo ceremonies in personations of certain maidens. Across the forehead are alternating black and white square figures arranged in two series, recalling corn or rain-cloud symbols. The neck is adorned by several strands of necklaces, the outermost of which, almost effaced, suggests rectangular ornaments. The garment worn by the

figure is evidently the ceremonial<sup>1</sup> blanket of a Pueblo woman, for no man wears this kind of garment. It has a white border and from its middle there hangs a number of parallel lines representing cords or a fringe, evidently the ends of a sash by which the blanket was formerly tied about the waist. It is instructive to notice that we find similar parallel lines represented in a picture of a girl from Sikyatki<sup>2</sup> where the blanket has the same rectangular form as in the prehistoric Mimbres picture. There can be no question that in this case it represents a garment bound with a girdle, or that the picture was intended for that of a girl or a woman. We have in this picture evidence that the same method of arranging the hair was used in the Mimbres Valley as in northern New Mexico. The leg wrappings suggest those used by Pueblo women, especially the Hopi, whose leggings are made of long strips of buckskin attached to the moccasins and wound around the lower limbs.

#### PRIEST SMOKING

The third human figure, found on a black and white bowl from a Mimbres ruin, is duplicated by another of the same general character depicted on the opposite side of the bowl. These figures (fig. 14) are evidently naked men with bands of white across the faces. The eyes are represented in the Egyptian fashion. In one hand each figure holds a tube, evidently a cloud-blower or a pipe, with feathers attached to one extremity, and in the other hand each carries a triangular object resembling a Hopi rattle or tinkler. The posture of these figures suggest sitting or squatting, but the objects in the extended left hand would indicate dancing. The figure is identified as a man performing a ceremonial smoke which accompanies ceremonial rites.

#### MAN WITH CURVED STICK

One of the most instructive food bowls found at Oldtown, now owned by Mr. Osborn, has on it a picture of two hunters, one on each side of an animal (fig. 15). One of these hunters carries in his hand a stick crooked at the end, its form suggesting a throwing stick.<sup>3</sup> Both hunters have laid aside their quivers, bows, and arrows, which are shown behind them. The picture of an animal between them has been so mutilated by "killing" or breaking the bowl that it is impos-

<sup>1</sup> Called also a "wedding blanket" since it is presented to a girl on marriage by her husband's family.

<sup>2</sup> 17th Ann. Rep. Bur. Amer. Ethnol., pl. 129, fig. a.

<sup>3</sup> The hand of the hunter pictured on a bowl already described (fig. 13), also carried a curved stick.

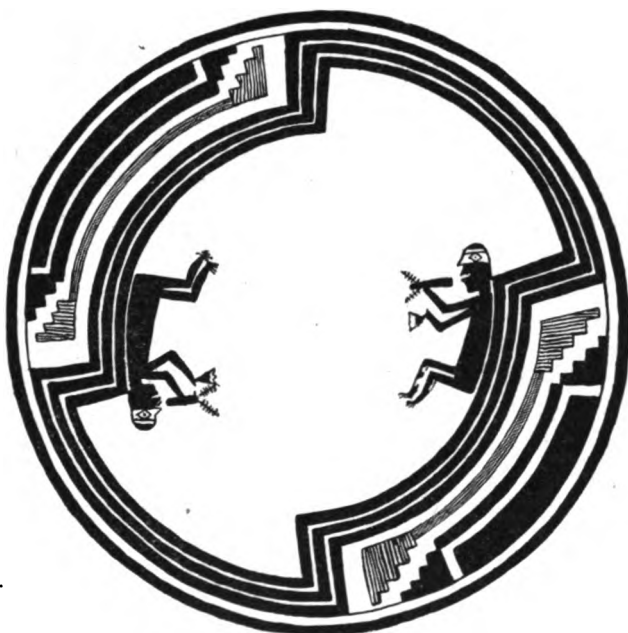


FIG. 14.—Priest smoking. Osborn Ruin.

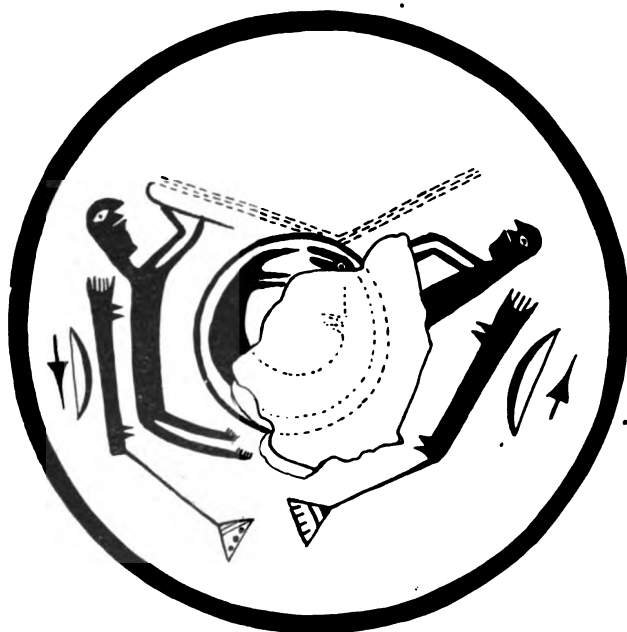


FIG. 15.—Man with curved stick. Oldtown Ruin. (Osborn collection.)  
Diam.  $5\frac{1}{2}$ ".

sible to identify it. From the end of this crook to the body of the animal there extend two parallel lines of dots indicating the pathway of a discharged weapon. Near the body of the animal these rows of dots take a new direction, as if the weapon had bounded away or changed its course. The rows of dots are supposed to represent lines of meal by which Pueblos are accustomed to symbolically indicate trails or "roads."

There is, of course, some doubt as to the correct identification of the crooked staff as a throwing stick, for as yet no throwing stick has been found in the Mimbres ruins. The resemblance of the crooked stick to those on certain Hopi altars and its resemblance to emblems of weapons carried by warrior societies is noteworthy. Crooked sticks of this character have been found in caves in the region north of the Mimbres.<sup>1</sup>

We find a survival of a similar crook used as sacred paraphernalia in several of the Hopi ceremonies, where they play an important rôle. As the author has pointed out, crooked sticks or gnelas (fig. 16) identified as ancient weapons surround the sand picture of the Antelope altar in the Snake Dance at Walpi, and in Snake altars of other Hopi pueblos, but it is in the Winter Solstice Ceremony, or the Soyaluña, at the East Mesa of the Hopi, that we find special prominence given to this warrior emblem. During this elaborate festival every Walpi and Sitcomovi kiva regards one of these gnelas as especially efficacious for the warriors, and it is installed in a prominent place on the kiva floor, as indicated in the author's account of that ceremony.<sup>2</sup>

The following explanation of these crooks was given him by the priests:

These crooks or gnelas have been called warrior prayer sticks, and are symbols of ancient weapons. In many folk tales it is stated that warriors overcame their foes by the use of gnelas which would indicate that they had something to do with ancient war implements. Their association with arrows on the Antelope altars adds weight to this conclusion.

The picture from Oldtown ruin of the hunter who has laid aside the quiver, bow, and arrow, and is using a similar gnela,<sup>3</sup> corroborates this interpretation.

Not all crooked sticks used by the Hopi are prayer sticks, or weapons, for sometimes in Hopi ceremonials a number of small shells are

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<sup>1</sup> Bull. 87, U. S. National Museum.

<sup>2</sup> The Winter Solstice Ceremony at Walpi. *Amer. Anthropol.*, 1st ser., vol. 11, Nos. 3, 4, pp. 65-87, 101-115.

<sup>3</sup> An ancient crook found in a cave near Silver City is figured by Dr. Hough. Bull. 87, U. S. National Museum.

tied to the extremity of a crooked stick forming a kind of rattle. In the Flute Ceremony a crooked stick is said to be used to draw down the clouds when the rain they contain is much desired.

Figure 16 is a representation of one of the crooks which was specially made for use in the Soyaluña at Walpi, in 1900. Similar crooks were set upright in a low mound of sand on the floors of all the kivas. Extending from the base of the crook to the ladder there

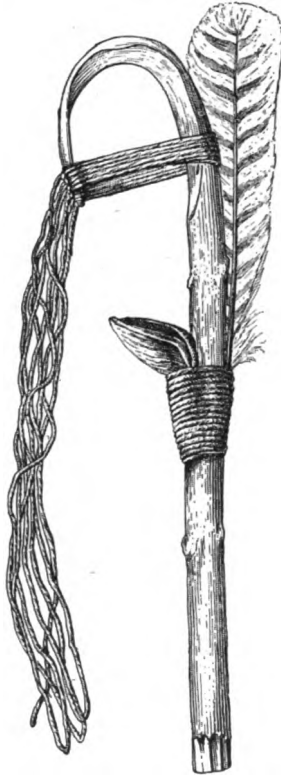


FIG. 16.—Hopi curved stick. Length 8".

was sprinkled a line of meal called the road (of blessings), over which was stretched a feathered string attached to the end of the crook. Midway in the length of the crook was attached a packet of prayer meal wrapped in cornhusk and a feather of the hawk, a bird dear to warriors, and other objects, which indicated a prayer offering. At the termination of ceremonies in which these crooks are made and blessed as prayer emblems by the Hopi they are deposited in shrines as recorded.

The crook (gnela) is used as a prayer emblem of warriors because it has the form of an ancient weapon, and while it assumes modifications in different Hopi ceremonies it apparently has one and the same intent, as in Soyaluña. This crook is sometimes interpreted as symbolically representing an old man with head bent over by age, but this interpretation is probably secondary to that suggested above, as so often happens in the interpretations given by primitive priests.

The true interpretation of the crooked prayer stick was pointed out by the author in his article on "Minor Hopi Festivals,"<sup>1</sup> as follows:

This crook is believed by the author to be a diminutive representation of an implement akin to a throwing stick, the object of which is to increase the



FIG. 17.—Human figure running. Oldtown Ruin. (Osborn collection.)  
Diam.  $7\frac{1}{2}$ ".

velocity of a shaft thrown in the air. Its prototype is repeatedly used in Hopi rites, and it occurs among Hopi paraphernalia always apparently with the same or nearly the same meaning.

In figure 17 is represented a person running with outstretched banded arms, holding in the left hand a bow, and in the other a straight stick. The head is circular with cross lines, a round, dotted eye, and two triangular ears. Another representation shows a human figure with a bow and arrow before the hands, accompanied by three animals, the middle one being a bird and the two lateral, quadrupeds.

<sup>1</sup> Amer. Anthropol., n. s., vol. 4, p. 502.



By far the most unusual group of human forms consists of two figures, one male, the other female, depicted on another bowl. The action in which these two are engaged is evident. The female figure has dependent breasts and wears a girdle. One hand is raised and brought to the face and the other carries a triangular object. The female figure has three parallel marks on the cheek, like the Hopi war-god. Behind the woman are several curved lines depicting unidentified objects.

The figure shown on one bowl (fig. 18) has several marked features, but the author is unable to suggest any theory of identification. It seems to be a seated figure with a human head, arms, and legs, the toes and fingers being like hands and feet. The forearm is drawn on the shoulder in the same way as in the one of the hunters (fig. 13).



FIG. 18.—Unidentified animal and bowl of unusual form. Oldtown Ruin. (Osborn collection.)

The eye, nose, and mouth are also human, but the body is more like that of an animal. The appendages back of the head are similar to those interpreted as feathers on the heads of certain animal designs.

On the theory that this is a seated human figure it is interesting to speculate on the meaning of the curved object represented on the surface of the bowl, extending from one hand to the foot. This object has the general form of a rabbit stick or boomerang, still used by the Hopi in rabbit hunting.<sup>1</sup>

<sup>1</sup> Rabbits are abundant in the Mimbres Valley and several well-drawn pictures of this animal are found on the pottery.

The well-drawn figure painted on a bowl (pl. 1, fig. 2) from Oldtown ruin represents a man with knees extended and arms raised as if dancing. This picture has characteristic markings on the face, but otherwise is not distinctive.

#### QUADRUPEDS

*Wolf*.—Although there are not sufficiently characteristic features represented in the next figure (pl. 2, fig. 1)<sup>1</sup> to identify it satisfactorily, the form of the head, tail, mouth, and ears suggests a wolf.<sup>2</sup> The square design<sup>3</sup> covering one side of the body seems to the



FIG. 19.—Antelope. (Osborn collection.) Diam. 10".

author not to belong to the animal itself, for an Indian who could represent an animal as faithfully as those here pictured would not place on it such markings unless for a purpose. It resembles the small blankets sometimes worn by pet dogs or horses among white people, which is a lame explanation, as dog and horse blankets were

<sup>1</sup> This picture resembles that of a wolf depicted on the east wall of the warrior chamber at Walpi. See Amer. Anthropol. n. s., vol. 4, pl. 22.

<sup>2</sup> Pictures of the mountain lion by Pueblo artists, at least among the Hopi, have the tail turned over the back. The animal on the Mimbres bowl having no horns is not a horned deer or antelope.

<sup>3</sup> The decoration of the bodies of animals with rectangular figures is a common feature in Mimbres pottery, as will be seen in pictures of birds soon to be considered.

unknown among Indians. The only theory the author has formed regarding this geometrical figure is that it is a variant of the Sikyatki habit of accompanying a figure of an animal with a representation of his shrine. This bowl is of black and white ware and is eleven inches in diameter by five and one-half inches deep.

*Antelope.*—There are two<sup>1</sup> figures of an animal with branching horns,<sup>2</sup> supposed to be an antelope, an animal formerly common in Mimbres Valley. In one of these (fig. 19) the head is held downward as if the animal were feeding; in the other (fig. 20) the neck is

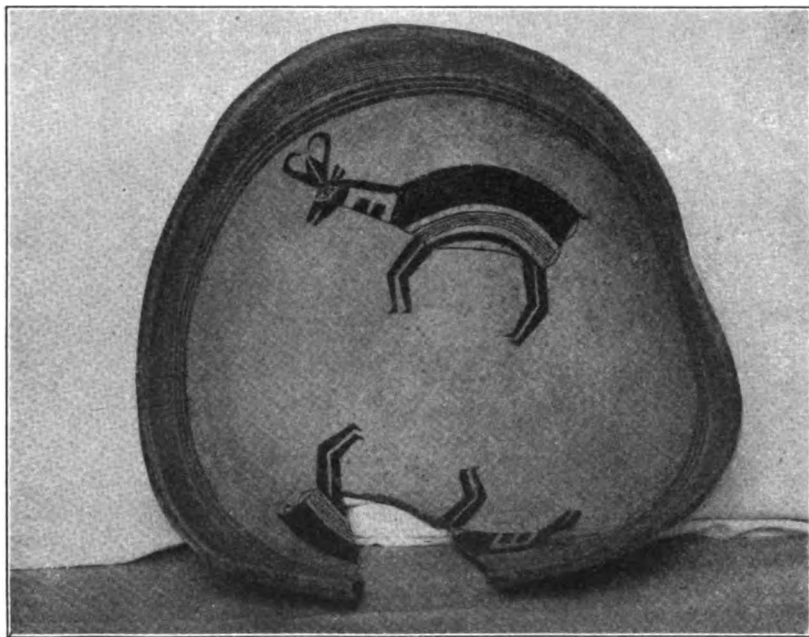


FIG. 20.—Antelope. Osborn Ruin. Diam. 10".

extended. A pair of markings on the neck are identical with those on pictures of the antelope still painted on modern pottery made by the Zuñi. A band, resembling a checkerboard, is drawn across the body of one; on the other are parallel lines.

Another figure referred to as an antelope appears to represent a young fawn, since, while it has all the characteristics of this animal,

<sup>1</sup> In addition to the figure with the hunters which is probably a deer, as it has not the antelope marks on the neck.

<sup>2</sup> These horns are represented on a plane at right angles to that in which they naturally lie.

the horns are wanting. This specimen (fig. 21) was found at Oldtown. The rectangular shape so often given to the bodies of animals drawn on Mimbres pottery is well shown in this specimen.



FIG. 21.—Fawn. Oldtown Ruin.

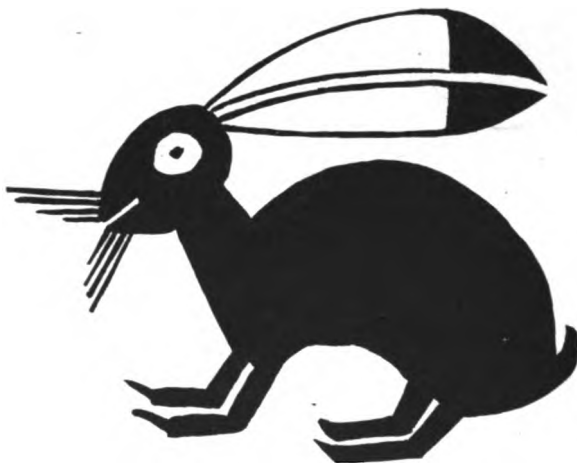


FIG. 22.—Rabbit. Oldtown Ruin. Diam.  $7\frac{1}{2}$ ".

*Mountain Sheep.*—It is evident from the form of the unbranched horns, the slender legs, and the head, that either a mountain sheep or mountain goat was intended to be represented in plate 2, figure 2.

The markings on the body are symbolic, suggesting lightning, and it may be added that the Hopi depict the lightning on the artificial horns mounted on caps and worn by them in presentations of dances in which they personate mountain sheep.

*Rabbit or Hare.*—The pictured representation (fig. 31) of a quadruped whose hindlegs are larger than the forelegs and whose long backward extending ears are prominent features, probably represents a rabbit or a hare. The eyes recall figures of birds depicted on bowls from the Little Colorado ruins in Arizona, where eyes are

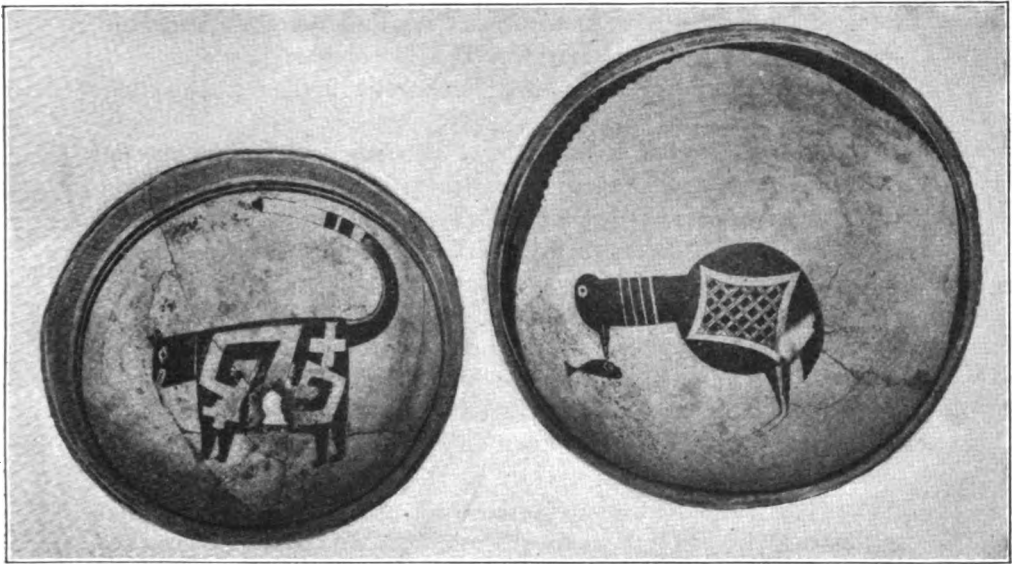


FIG. 23.—Mountain lion or wild cat.  
(Osborn collection.)

FIG. 25.—Bird E. Osborn Ruin.  
(Osborn collection.)

depicted on one side of the head in violation of a law of perspective in which only one eye can appear on a lateral view. The figure appears to have a tuft of grass in the mouth. The geometric markings on the body are different from those of any known species of rabbit and belong to the category of symbolic designs.

The author excavated at Oldtown a food bowl, the figure on which was undoubtedly intended for a rabbit (fig. 22). The head, ears, body, legs, and tail are well made, leaving no question of the intention of the artist; but if there were any doubt of the identification it is dispelled by the representation of the mouth, on which the sensitive hairs or bristles are represented.

*Mountain Lion.*—One of the Oldtown bowls is decorated with a representation of the wild cat or mountain lion, and is a fair example of archaic design (fig. 23).<sup>1</sup> The feature that distinguished this quadruped is the position of the tail which, like those of Pueblo pictures of mountain lions or cats, is bent forward over the back.

Both head and body are rectangular and the legs are short and stumpy with sharp curved claws. The ears, mouth, and teeth have characteristic features of carnivora and the tail is banded, especially near the end.

The geometric design on the side of the body consists of an angular, S-shaped design with two equal armed stars, the latter associated with the mountain lion in Pueblo symbolism. The single figure drawn on this bowl occupied the middle of the interior, but in the next bowl this figure is duplicated.

The two figures on another bowl also represent some cat, or mountain lion, but the geometric figure on its body differs so much from the first specimen that it may belong to a different genus. The geometrical designs occur on both the anterior and posterior extremities of the rectangular body and consist of triangular figures with parallel lines and terraces recalling rain-clouds. This bowl is owned by Mr. E. D. Osborn, and was found at Oldtown. The decorations on the two quadrants alternating with the animal figures are bands from which other markings radiate to the side of the bowl.

*Badger.*—The quadruped drawn on the inside of a bowl found at Oldtown, and now owned by Mr. E. D. Osborn, has some resemblances to a badger, especially in the head, ears, teeth, and tail. The geometrical design on the body of this animal consists of an unequal sided rectangle enclosing four triangles with angles so approximated as to form an enclosed rectangle. The head has two bands extending longitudinally, apparently conventionalized markings characteristic of this animal, as they do not occur on deer, wildcats, or mountain sheep.

*Birds.*—As has been pointed out in the author's identifications<sup>1</sup> of designs on Sikyatki pottery, those representing birds are among the most abundant. The same holds also in the pottery from the Mimbres, where several figures identified as birds occur on food bowls. Two of these are duplicated on the same vessel, practically the same figure being repeated on opposite sides. In the latter case each member of the pair faces in an opposite direction or is represented as if moving with the middle of the bowl on the left.<sup>2</sup>

<sup>1</sup> 17th Ann. Rep. Bur. Amer. Ethnol., p. 682.

<sup>2</sup> This is known as the sinistral circuit and is regarded as beneficial in Hopi ceremonials.

The various birds differ considerably in their forms, organs, attitudes, and appendages. Two of the pictures seem to represent the same bird, but the others belong to different genera. There are one or two figures in which feathers can be distinguished, but as a rule they are fewer in number and the feathers less conventionalized than in Sikyatki pottery.

Pending the difficulty in identifying the various designs representing birds, they are designated by letters A, B, C, D, etc.

*Bird A.*—The figure shown in plate 3, figure 1, is represented by two designs, practically the same, repeated so far as appendages go, but quite different in the ornamentation of their bodies. One of these has the same geometrical figure on its body as on one of the quadruped pictures, the second has a different design. Both birds have wings outspread as if in flight, in which the feathers are well drawn in detail, especially the wing on the side turned toward the observer. That on the opposite side is simply uniformly black. The feathers of its companion on the other side of the bowl are indicated by parallel lines. The tail is long and forked at the extremity, suggesting a hawk, and is decorated for two-thirds of its length with cross-hatched and parallel lines. A triangular appendage arises from the under side of the tail at the point where the line decoration ends, forming an appendage which is likewise represented in the companion picture.

*Bird B.*—Bird B (pl. 3, fig. 2) is painted on the interior of a food bowl of black and white ware, ten inches in diameter by five inches deep. Its body is oval, the head erect and undecorated, and the tail twisted from a horizontal into a vertical plane as is customary in representation of lateral views of birds from Pueblo ruins. The geometric figure on the body is unfortunately somewhat obscured by the plaster used in mending, but several parallel bars that may represent feathers of the wings show through it, and a number of other designs or parallel lines are apparent. An appendage of triangular form hangs from the lower margin of the body and indicates the position of one leg; the other leg is missing.

*Bird C.*—Bird C, shown in plate 4, figure 1, occurs on a black and white bowl that measures ten inches in diameter, five and one-half inches in depth. The figure occupies the circular zone in the middle of the bowl and is enclosed by parallel lines which surround the bowl near the rim. The top of the head, which is globular, is white in color, the beak projecting and the eyes comparatively large. The body is likewise globular and is covered by a square geometrical design the details of which are considerably obscured by the hole in the middle of

the jar. A number of parallel lines of unequal length, turned downward, hang from the rear of the body and form the tail. The long legs suggest a wading bird, and the widely extended claws point to the same identification.

*Bird D.*—One of the most instructive figures of birds occurs on a bowl from Oldtown ruin. This bowl (fig. 24) is now owned by Mr. E. D. Osborn, by whom it was found. The bird depicted on it is seen from the back; its wings are drooping, and parallel lines indicate feathers. The legs, drawn backward, terminate in three toes, and the tail, slightly bent to one side, is composed of several feathers.

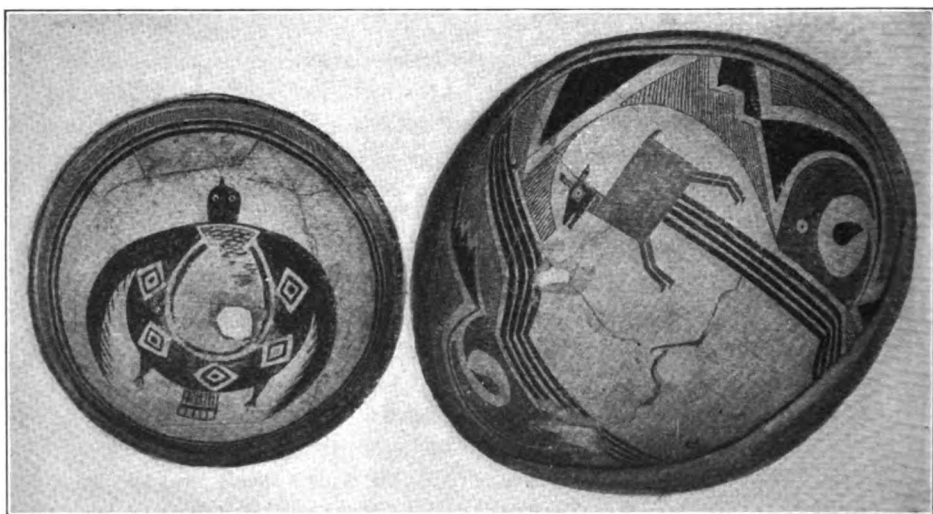


FIG. 24.—Bird D.  
(Osborn collection.)

FIG. 29.—Unidentified animal. Oldtown Ruin.  
(Osborn collection.)

The head is globular with two eyes on the back and a short pointed beak. As in all other zoic figures the geometric figures on the back of the body are the most characteristic. The middle of the body is occupied by an oval design through which may be seen the perforation with which the bowl was killed. At one end there is a triangular design with cross lines which extend partly over the oval figure where, except at one point, they are obscure.

Four quadrilateral designs are distributed at intervals around the oval figure. Each of these has sides of about equal length and a dot medially placed in a smaller figure contained in a larger.

*Bird E.*—The bird shown in figure 25 (p. 35) from the Osborn ruin has a body form not unlike that of plate 4, figure 1, but the geometric



design on the body, although rectangular, has incurved sides and is covered with cross lines suggesting a net. Its neck is girt by four rings, head small, without feathers, eye minute, bill comparatively long and pointed recalling that of a snipe which is also suggested by long legs and in a measure by the form of the tail.

This bird is undoubtedly aquatic, as indicated by the figure of a fish which it appears to be on the point of capturing or devouring.

*Bird F.*—The bird shown in plate 4, figure 2, is different from any of the above and is distinguished readily by the four curved lines on the head suggesting the quail. The pointed tail is marked above and below with dentations, formed by a series of rectangular figures which



FIG. 26.—Bird G. Oldtown Ruin. (Osborn collection.) Diam. 10".

diminish in size from body attachment to tip. The body itself is marked posteriorly with parallel lines, rectangular and curved figures suggesting wings.

The bowl (fig. 26) has three animals figured upon it forming a graceful combination. The most striking represents a long-billed bird with one wing notched on the inner margin. The tail of this bird is differently drawn from any of the other birds in the collection and has representations of six feathers. In front of this bird, with the point of the snout at the tip of the bill of the bird, is a lizard-shaped head covered with scales and two round eyes. The other remarkable figure also has extended forelegs, but the body is so broken that identification is quite impossible. Like the figure of the lizard, it also has a lozenge head and two eyes. The geometrical designs on the bowl are characteristic.

## ANIMALS NOT IDENTIFIED

*Unidentified Animal.*—It is difficult to tell exactly what animal was intended to be represented by that shown in plate 5, figure 2. Its head and mouth are not those of any of the horned animals already considered, although it has some anatomical features recalling a mountain sheep. The extension back of the body has a remote likeness to a fish, but may be a bird or simply a conventional design. The geometrical figure covering the side of the body bears some likeness to one depicted on a bird, as shown in plate 3, figure 1. The same geometrical figure sometimes also occurs separated from any animal form in Sikyatki pottery.<sup>1</sup>

The bowl is ten inches in diameter, five inches in depth, and the figures are painted red on a white ground.

*Unidentified Animal.*—One of the most remarkable of many figures on bowls from Oldtown in the collection of Mr. E. D. Osborn is shown in figures 27, 29 (p. 38). Three colors enter into the decoration of this bowl, black, white, and brown, and there are two types of ornamentation, one zoic, the other geometric. The bowl itself was much broken when found, but not so mutilated as to hide the main designs.

The zoic figures represent animals with square bodies, four legs, ears, head, and tail like a young antelope. There is no design on the side of the body, but in its place four broad parallel bands extend from the belly across the bowl. Each group of parallel lines changes its direction, widening in their course or near the ends where they enlarge for the accompanying figure. The markings on the necks of these figures suggest those on fawns.

The elaborate geometric figure composed of a scroll and comma-like dot and eye is a highly conventionalized symbol, possibly of some animal, as a bird's head, common on Casas Grandes pottery.

There is a bowl on exhibition in the Chamber of Commerce at Deming with a picture of a quadruped resembling a deer, but the base is so fractured in killing that it is difficult to determine the shape of the body or its decoration.

*Unidentified Animal.*—One of the most instructive figures of the collection appears in duplicate on a large food bowl (pl. 5, fig. 1). This vessel is black and white in color and measures fifteen inches in

<sup>1</sup> 17th Ann. Rep. Bur. Amer. Ethnol., pls. 121a, 138c. There are one or two examples of Sikyatki pottery where a geometrical design is attached to an animal figure which leads to the belief that possibly the figure attached to the rear of the above may not represent a part of another animal but rather a geometrical design of unknown significance, in this particular recalling old time Hopi ware.

diameter by six inches deep. The two designs occur on the two sides of the interior of the bowl, the middle of which is left without decoration.

The body of this creature is elongated and tapers backward, being continued into a tail like that of the lizard. The head is long and the snout pointed. Only two legs are represented, and these are situated far back on the body near the point of the origin of the tail from the body. A lozenge-shaped symbol forms the geometrical design on the side.



FIG. 27.—Unidentified animal. Oldtown Ruin. (Osborn collection.)

The presence of only two legs in this figure would seem to indicate that a bird was intended, but no bird has a tail like this figure; and the prehistoric potters of the Mimbres certainly knew how to draw a bird much better than this would imply. The exceptional features of this drawing, doubtless intentional, belong neither to flesh, fish, nor fowl, rendering its identification doubtful.

#### GRASSHOPPER<sup>1</sup>

A figure on a bowl here represented (pl. 6, fig. 1) is painted in "black or brown on a background of bluish wash over a yellow color."

<sup>1</sup> This figure may also be identified as a locust.

This bowl is eleven inches in diameter, five inches in depth. The figure is a remarkable one, having features of several animals, but none of these are more pronounced than its insectiform characters, among which may be mentioned the antennæ, three legs on one side (evidently three pairs of legs, for that in the back is simply introduced in violation of perspective), and an extended segmented abdomen attached to the thorax and terminating in a recurved tip. The character of the appendages to the thorax, or the wings, leaves no doubt that a flying animal was intended, and the legs and head being like an orthopterous insect, it may be provisionally identified as a "grasshopper."<sup>1</sup>

While the general form of head, thorax, and body appear from an inspection of the figure, it may be well to call attention to certain special features that illustrate primitive methods of drawing. The most striking of these is seen in the abnormal position of the leg which arises from the thorax on the back in the rear of the so-called wings. This abnormal position was introduced by the artist to show the existence and form of the legs on the right side; the appendage corresponds with one of the three on the left side, which have the proper position but are much smaller. A similar delineation of organs out of place not seen or turned away from the observer was common among the prehistoric artists of the Pueblo region and is paralleled by the representation of two eyes on one side of the head already mentioned. The two "wings," each ending in white circles with dots or crosses, are supposed, on the theory that this is a grasshopper, to represent wing covers or elytra, which of course the prehistoric people of the Mimbres did not differentiate from folded wings. It is possible that wing cover and wing may be represented on one side and that corresponding organs on the right side of the body are omitted. The thorax is covered with regularly arranged rows of dots formed by parallel lines crossing at an angle, forming purely arbitrary decoration representing the geometric designs on the bodies of other animals.

#### FROGS AND BIRDS

One of the few bowls obtained on which animals of two species were depicted on the same vessel was excavated by the author at Oldtown. This remarkably fine specimen (pl. 7, fig. 1) has figures of

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<sup>1</sup> Possibly depicted on a food bowl because grasshoppers were eaten by the prehistoric people of the Mimbres.

two birds and two frogs<sup>1</sup> drawn in opposite quadrants, being unique in this particular. The two birds and frogs are not very unlike those already described but have certain characteristic features, especially in the geometric designs on their bodies.

The bowl is warped into an irregular shape and made of thin ware, probably distorted in firing. It was found under the floor of one of the central rooms in the Oldtown ruin, almost completely covering the skeleton of a baby.

On another bowl (pl. 6, fig. 2) there is depicted a frog very like that last mentioned. The frog being an amphibian was undoubtedly greatly revered by the ancient people of the Mimbres Valley.

#### HORNED SNAKE

The serpent with a horn on the head is pretty generally regarded as a supernatural being, and its pictures and effigies occur on modern Hopi, Zuñi, and other Pueblo paraphernalia. It is an ancient conception, for it is figured on prehistoric pottery from all parts of the Pueblo area, having been found as far south as Casas Grandes in Chihuahua. It is to be expected that a people like the ancient Mimbrenos who adorned their pottery with so many well drawn zoic figures would have included the horned serpent, provided this reptile was a member of their pantheon. The nearest approach to a figure of such a monster is found on a large pottery fragment found by Mr. Osborn twelve miles south of Deming. This fragment covered the cranium of a skeleton and was perforated or "killed" like a whole bowl.

A very large number of pictures of the horned snake from localities all over the Southwest might be mentioned, but a few examples are adequate to show how widespread the conception was in ancient times. They occur among the Tewa, Keres, Zuñi, Hopi and other Pueblos and vary greatly in details, but in all instances preserve the essential symbolic feature—a horn on the head and a serpentine body.

The horned serpent is known to the Hopi as the plumed serpent, and when represented by them has a bundle of hawk feathers as well as a horn attached to the head. Effigies of this being, also with horn

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<sup>1</sup> A picture of a horned toad on a food bowl was recorded from Cook's Peak by Professor Webster, and there is a picture of what appears to be the same reptile in Mr. Osborn's collection. It is of course sometimes difficult to positively distinguish representations of frogs, toads, lizards, and Gila monsters, but the anatomical features are often well indicated.

and feathers, are used in several ceremonies, as the Winter Solstice,<sup>1</sup> and a dramatic festival<sup>2</sup> which occurs yearly in March. Wooden representations of the same horned snake are carried as insignia by a warrior society called the Kwakwantu,<sup>3</sup> in the New Fire Ceremony. The priests of the Tewan pueblo, Hano, among the Hopi also have effigies of the horned snake, the worship of which their ancestors brought to Arizona from New Mexico. These effigies are yearly made of clay and form conspicuous objects on the December altars of that pueblo.



FIG. 28.—Serpent. Osborn Ruin. (Osborn collection. E. D. O. Jr. del.)

The head shown in figure 28 has a horn curving forward almost identical with that on the head of a horned serpent on a bowl from Casas Grandes in the Heye collection. Its gracefully sinuous body is decorated with alternating geometric figures, curves and

<sup>1</sup> The Winter Solstice Ceremony. *Amer. Anthropol.*, 1st ser., vol. 11, Nos. 3, 4, pp. 65-87, 101-115.

<sup>2</sup> A Theatrical Performance at Walpi. *Proc. Washington Acad. Sci.*, vol. 2, pp. 605-629. Native pictures of the Hopi horned snake may be found, pl. 26, 21st Ann. Rep. Bur. Amer. Ethnol.

<sup>3</sup> The horned serpent cult at Walpi is said to have been introduced from the south.

straight lines.<sup>1</sup> Accompanying the figure of a serpent is a well-drawn picture of a turtle which is decorated on the carapace with a rectangular area on which is painted a geometric figure recalling that on bodies of birds and some other animals.

#### FISHES

One of the bowls (fig. 30) from the Oldtown ruin has two fishes depicted on opposite sides of the inner surface. These fishes resemble trout and are of different colors, black and reddish brown figures

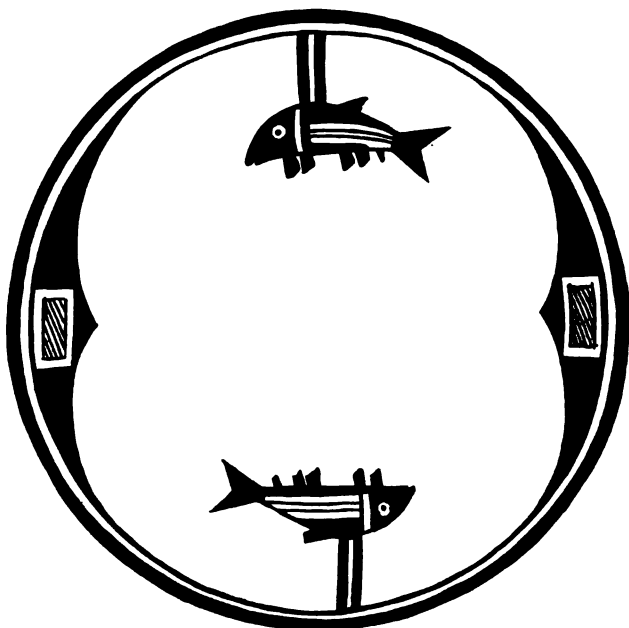


FIG. 30.—Fish. Oldtown Ruin. Diam. 9".

painted on a white ground. They are represented as hanging from two parallel lines surrounding the rim of the bowl. These fishes are so well drawn that there is no doubt what animal was intended to be here represented. On the interior of another bowl excavated by the author at Oldtown there is a picture of a fish which recalls the two

<sup>1</sup>Of all the designs representing the horned snake known to the author this picture from the Mimbres resembles most closely the pictures of this being on pottery from Casas Grandes. It has, however, the single horn found on the clay image in the Hano altar of the Winter Solstice Ceremony, although quite unlike figures on pottery from the Pajarito region. The bodily decorations in the Mimbres bowl are unlike those of the Hopi horned snake.

just mentioned.<sup>1</sup> It may be mentioned that fishes are not represented in the beautiful specimens of pottery from Sikyatki,<sup>2</sup> possibly for the simple reason that there are no streams containing fish in the neighborhood of Hopi ruins. In the Mimbres, however, fish are still found and were no doubt formerly abundant and well known to the prehistoric inhabitants,<sup>3</sup> being looked upon by them as water symbols in much the same way as the frog is at present regarded by Zuñi and Hopi.

Another fish figured on a bowl from Oldtown, is unfortunately broken near the tail. The accompanying decoration has apparently another figure behind this fish, but its complete form is obscured by the perforation made in killing the vessel.

The most problematical of all the life figures on the Mimbres pottery is shown in plate 7, figure 2. This figure occurs on a black and white food bowl, eleven inches in diameter, four and one-half inches in depth. In support of the theory that the two figures here depicted represent fishes, we have the pointed head without neck, the operculum as a white crescentic design, two fins (pectoral, ventral, and anal), the median (adipose?) dorsal fin unpaired, and a long tail bifurcated at the extremity. The resemblance of these figures to the undoubted fishes on bowls previously mentioned is conclusive evidence that they represent the same animal.

#### GEOMETRICAL FIGURES

The geometrical designs on Mimbres pottery are rectangular, curved, and spiral, the first form being the most common. These units are arranged in twos or fours, and although they consist often of zigzag or stepped figures, the triangle and rectangle predominate. The geometrical designs are rarely colored, but commonly filled in with hachures and parallel lines. There are seldom decorations on the outside of the Mimbres bowls, in which respect they differ from ancient Hopi (Sikyatki) vessels elsewhere figured.<sup>4</sup> Conversely, that part of the interior of the bowl which surrounds the central design, oftentimes elaborately ornamented in Mimbres pottery, is very simply

<sup>1</sup> The Mimbres formerly had many more fishes than at present, and Bartlett records that his men often brought in fine trout for his camp. These, with turkeys, quail, deer and antelopes, led him to say that his "fare might be called sumptuous in some respects" (*op. cit.*, p. 236).

<sup>2</sup> Fishes are sometimes represented on Keresan pottery.

<sup>3</sup> As elsewhere mentioned in this paper, one of the bird figures (fig. 25) has a fish in its mouth.

<sup>4</sup> 17th Ann. Rep. Bur. Amer. Ethnol., Part 2, figs. 277-355.



decorated in Sikyatki pottery. Encircling lines on Mimbres pottery are continuous, whereas at Sikyatki they are broken at one or more points by intervals known as the "life gateways" or "lines of life."<sup>1</sup> The geometrical figures on the inside of every bowl sometimes surround a central region on which no figures of animals or human beings are drawn, but which is perforated.

The more strikingly characteristic forms of geometrical figures are shown in designs on plate 8. Certain of the geometrical figures drawn on the sides of animals as on the wolf (pl. 2, fig. 1), the antelope (figs. 19 and 20), the mountain sheep (pl. 2, fig. 2), the unidentified animal and bird (figs. 18 and 25), the reptile (fig. 28),



FIG. 31.—Rabbit and geometrical designs.

also appear without the animals and probably have the same significance<sup>2</sup> in both instances.

No geometrical figures were identified as representing sun, moon, earth, or rain-clouds. A few crosses, circles, triangles, and irregular quadrilateral designs combined with zigzag stepped figures and interlocked spirals and highly interesting swastikas (fig. 31) form the

<sup>1</sup> Ceremonially, every piece of pottery is supposed by the Hopi to be a living being, and when placed in the grave of the owner, it was broken or killed to let the spirit escape to join the spirit of the dead in its future home. There is no evidence that the Sikyatki mortuary pottery was purposely broken when deposited in the grave, and probably no need of perforating it to allow free exit of the spirit, for the broken encircling line, "life gateway," absent in Mimbres pottery, but almost universally present in ancient Hopi pottery, answered the same purpose, in their conception.

<sup>2</sup> Following Hopi analogies, where these geometrical figures frequently occur with animals they may have the same symbolic meaning as when alone, and represent shrines or prayer-offering houses.

majority of the designs.<sup>1</sup> Several geometric designs, as those on the bodies of figures 25 and 26, appear on Sikyatki pottery (see 17th Ann. Rep. Bur. Amer. Ethnol., plate 121) ; others resemble Pueblo symbols of wide distribution, but the majority are unique. The geometric designs on the bodies of life-figures vary with the animal depicted, but the same genus of animals does not always have the geometric figure, although almost identical designs occur on the bodies of different genera. It is recognized that a comparison of designs on Southwestern pottery shows a general uniformity in geometrical pattern which renders it very difficult to distinguish different local areas of development, and may be the result of more extensive inter-

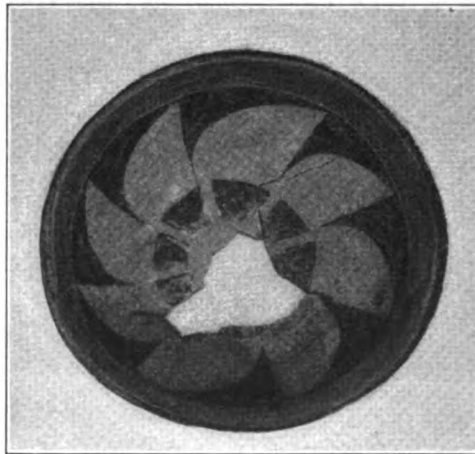


FIG. 32.—Geometrical figure. (Osborn collection.)

change of ideas and a greater uniformity of cultural conditions. The pottery of the Mimbres shares with the rest of the Southwest several well-known geometrical designs which no doubt date back to an earlier epoch than the evolution of animal figures, but it also has several decorations of geometrical patterns (fig. 32) that are peculiar to it and which, taken with the characteristic zoic figures, serve to differentiate it from other local areas. Mimbres pottery as pointed out by others has a general likeness to that from Casas Grandes Valley in Chihuahua, a resemblance which no doubt increases as we follow the river to Lakes Palomas and Guzman.<sup>2</sup> The resemblance is not close

<sup>1</sup> Unfortunately there are few decorated vases represented in the collection, but exploration in the field may later bring many of these to light.

<sup>2</sup> The author brought to Washington fragments of a food bowl from the ruin near Byron Ranch, identical with Casas Grandes ware.

enough to indicate identity, but we have enough material to support the belief that the archeological area in which it occurs is Mexican, unlike that of any other ceramic area in Arizona or New Mexico. Here a specialized symbolism has been developed which is different from that of the Rio Grande, or the Upper Gila-Salt area, and that characteristic of the great Lower Gila in which lie the compounds like Casa Grande. The Mimbres Valley archeologically is the northern extension of a culture area which reached its highest development on Casas Grandes River.

### CONCLUSIONS

Geographically the Mimbres Valley is the northern extension of the drainage area of the large interior plateau, the lowest level of which is occupied by Palomas, Guzman, and other so-called lakes. The Casas Grandes, Mimbres, and other rivers contribute their scanty waters to these lakes, which have no outlets into the sea. As a rule the thirsty sands along the course of the river drink up the surplus waters of the Mimbres or cause them to sink beneath the surface, to reappear when the configuration of lower clay or rock formations forces them from subterranean courses. Considering the similarity in climatic and geographical conditions in the northern and southern ends of this plateau, we would expect to find cultural likenesses in the prehistoric inhabitants of the Mimbres and Casas Grandes valleys, but such is not the case. The absence of relief decoration combined with painting, so common in the pottery from the Casas Grandes region, separates the Mimbres ware from that found far to the south.<sup>1</sup>

There are evidences that the course of the Mimbres River through Antelope Plain has from time to time changed considerably, and although a section of its bed now lies east of the Florida Mountains, the river probably formerly made its way to the west of the same in its course to Mexico. Modifications or changes in the bed of this river have had in the past much to do with the shifting of population and obliteration of prehistoric sites, either by washing them away entirely or burying them out of sight or deeply below the surface. This concealment of evidences of prehistoric occupancy has also been aided by frequent sandstorms, when considerable quantities of soil have been transported from place to place and deposited on walls or covered implements lying on the surface of the ground. It is also

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<sup>1</sup> We must look to renewed explorations to shed light on this and many other questions which the paucity of material is yet insufficient to answer.

possible that there has been a slow change of climate, causing a desiccation which may have been so widespread that the inhabitants of the plain were driven up river into the hills where water was more abundant, but it is well to remember that abandoned settlements or ruins exist on the banks of the Mimbres where there is still abundant water, as well as in the plain which is dry.

The depth of the present water level, as shown by drilling for wells, varies in different places in the valley, but in the neighborhood of the hills there are many springs. The configuration of the surface of the hard clay strata lying beneath the soil here and there often forces the water to rise to the surface, and ruins occur at points where at present there are no signs of surface water, although at the time they were inhabited there may have been more water.<sup>1</sup> Whether or not this water was brought to certain ruins by a system of artificial irrigation, the canals of which have been obliterated, we cannot say, but there is only scanty evidence that the climate here, as elsewhere, has radically changed since man occupied the valley.<sup>2</sup>

Although there is a remote likeness between the terraced house or pueblo community of northern New Mexico<sup>3</sup> and the prehistoric houses of the Lower Mimbres, its closest resemblance is to an antecedent type, for it is possible that the terraced pueblo culture in the Rio Grande Valley was preceded by another. This earlier type of habitation of the Mimbres Valley was like the fragile-walled house of the natives inhabiting a large part of Arizona and New Mexico before the Puebloan, and we have evidence that this older style of building was scattered over the present Pueblo area. There is no evidence of a terraced dwelling or pueblo more than one story high

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<sup>1</sup> In dry seasons the river flows under the superficial soil at a varying depth, but in floods it follows the surface bed.

<sup>2</sup> As the author has pointed out in several articles, the abandonment of Southwestern ruins is due to a variety of causes, chief of which are changes of climate. It is often due to other more local causes, as attacks by hostiles, salinity of soil, poor site for defence, presence of wizards, contagious diseases, etc.

<sup>3</sup> The designation "pueblo ruins" sometimes applied to any cluster of ancient house walls in Colorado, Utah, New Mexico, and Arizona, should be restricted to a well-defined architectural type which originated and reached its highest development in a small area in New Mexico. It was eventually carried by colonists in all directions from the center of origin, becoming intrusive as far west as the Hopi, Zuni, and Little Colorado. The boundaries of this type never extended into Mexico in prehistoric times. The ruins along the Mimbres are not community houses of terraced character and should not be called pueblo ruins.

in the Mimbres or the inland basin in which it lies. In other words the ruins of the Mimbres may be regarded as older than true pueblo ruins, resembling an earlier type of dwelling that antedated, in the Rio Grande Valley, the terraced houses.

The author does not find any architectural features in the remains of the prehistoric habitations of the Mimbres Valley suggesting Casa Grande compounds, or those massive buildings with encircling walls which are characteristic of the plains of the Gila. Although the walls of the Casas Grandes, in Chihuahua, are constructed in the same way and out of material like those of Casa Grande on the Gila, the architectural feature, an encircling wall of the latter, has not yet been recognized on the Sierra Madre plateau.<sup>1</sup> Objects found in the Gila ruins are somewhat different in form from those of Chihuahua, while pottery from the Gila Valley ruins and that from the inland plateau in northern Chihuahua is markedly different, with very divergent symbolism. Not only do forms of stone implements of a shape unknown in southern Arizona occur in southern New Mexico, but also the methods of disposal of the dead differed among the two people. The latter practised inhumation only, the other both cremation and inhumation. The aborigines of the Mimbres Valley placed a bowl over the head or face of the dead, a practice which, so far as known, does not appear to have been so commonly in vogue in inhumation of the prehistoric people of the Lower Gila plains.

The conventional geometric symbols on prehistoric Mimbres pottery are readily distinguished from those on ware from Tulerosa, a tributary of the San Francisco. The most significant feature of the Mimbres pottery is that fifty per cent of the figures on it represent men or animals, while out of a hundred bowls from the Gila not more than two or three are ornamented with zoic designs. As we know comparatively nothing of the pottery of the sources of the Upper Gila and that part of its course which lies between the Tulerosa and the Mimbres, we can at present venture very little information on ceramic relations, but similarities or mixtures would naturally be expected, due to contact or overlapping, the type of the one valley overlaying that of the other or mingling with it.

The sources of the Upper Salt, the largest tributary of the Gila, lie far from the Mimbres, and close relationship in the pottery of the

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<sup>1</sup> This statement is made with reservation, as the true architectural form of the Casas Grandes of Chihuahua is not yet known. The published plans show no encircling wall like that of Casa Grande on the Gila; probably the Casas Grandes of Chihuahua belong to a highly specialized type different from others.

ancient people inhabiting its banks is not found or expected. It is not known whether the pottery from the Upper Salt and that from the Upper Gila is similar, for our museums have no extensive collections from the latter region from which to make comparisons and draw conclusions. We know practically nothing of the prehistoric culture of the Upper Gila.

The aborigines of the Mimbres, like those of some of the former dwellers in Pajarito Park in New Mexico, practised a modified form of urn burial, but the latter rarely decorated their pottery with figures of animals. As compared with known Pueblo ceramics, the Mimbres pottery appears to be more closely allied to ancient Keresan than to old Tewan. Judging from what remains, the houses architecturally had little in common with true pueblos.<sup>1</sup> There are no evidences of circular subterranean kivas with pilasters, ventilators, deflectors, and niches, as in northern New Mexico, although there is a fairly large proportion of subterranean rooms or pit dwellings which may have been their prototypes. Architecturally the prehistoric habitations of the Mimbres Valley represent an old house form widely distributed in the Pueblo region or that antedating the pueblo or terraced-house type before the kiva had developed.

There are not sufficient data at hand to determine satisfactorily the kinship of the prehistoric inhabitants of Mimbres Valley, but as far as may be judged by pottery symbols it may be supposed that their culture resembled that of other sedentary people of New Mexico and Arizona in early times, as well as that of peoples of Chihuahua. It appears to the author that there are so many cultural similarities among the sedentary people which inhabited the Sierra Madre plateau, of which the Antelope Plain of Mimbres Valley is only a northern extension, that we may regard their culture as closely related. A specialized high development of this inland culture took place along the Casas Grandes River, culminating in Chihuahua. The Mimbres Valley was inhabited by people somewhat less developed in culture.

Although the ancients of the Mimbres were related on the one side to the Pueblos of New Mexico and on the other to more southern people, that relationship existed between the ancestors of the same rather than with modern Pueblos, and reached back to a time before

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<sup>1</sup> While neither the terraced nor the "compound" type of architecture has been seen in the Mimbres for the reason that both were specialized in their distinct geographical areas, the fragile-walled, jacal type of habitation is identical in form, though not in time, in all three localities.

the terraced communal house type originated. This type of house arose in northern New Mexico and spreading from this center extended down the San Juan as far as the Hopi, while modifications are also found in certain ruins on the Gila and Little Colorado, which, like Zuñi, it profoundly influenced, but its influence never reached as far as the Lower Mimbres.

A comparison of the limited archeological material from the Mimbres with that from other localities in the Southwest suggests a provisional hypothesis that the prehistoric culture of this valley was not modified by terraced architecture nor greatly affected by that of the Lower Gila type, both of which evolved independently and locally, but belonged to an older type with which it had much in common.







1



2

FIG. 1.—WOMAN DANCER. BLACK AND WHITE WARE. 12 BY 6 INCHES. OSBORN RUIN

FIG. 2.—DANCING FIGURE. RED DECORATION. DIAMETER 5 INCHES. OSBORN RUIN





FIG. 1. TWO WOLVES. BLACK AND WHITE WARE. 11 BY 5½ INCHES. OSBORN RUIN

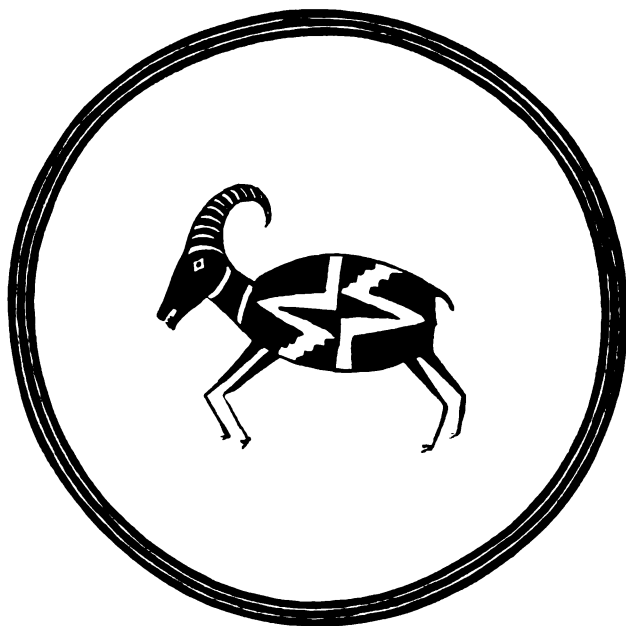


FIG. 2. MOUNTAIN SHEEP BLACK AND WHITE WARE. 11 BY 5½ INCHES. OSBORN RUIN





1



2

FIG. 1.—BIRD A. RED AND WHITE WARE. 9 BY 4 INCHES. OSBORN RUIN  
FIG. 2.—BIRD B. BLACK AND WHITE WARE. 10 BY 5 INCHES. OSBORN RUIN



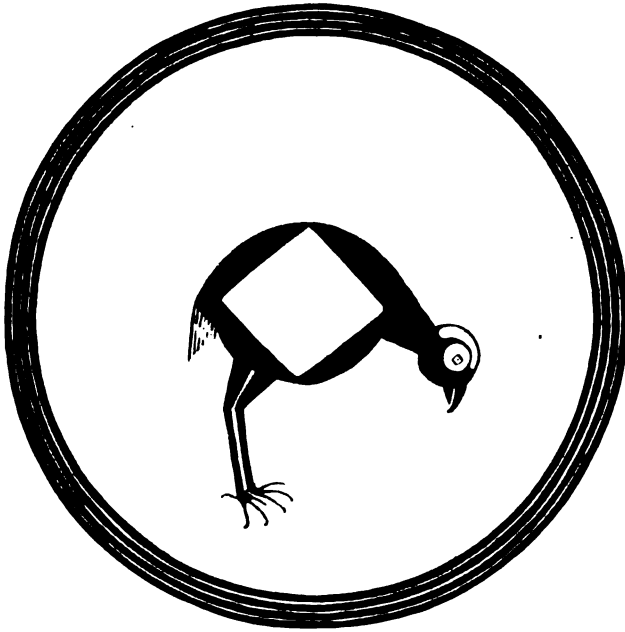


FIG. 1. BIRD C. BLACK AND WHITE WARE. 10 BY 5½ INCHES. OSBORN RUIN

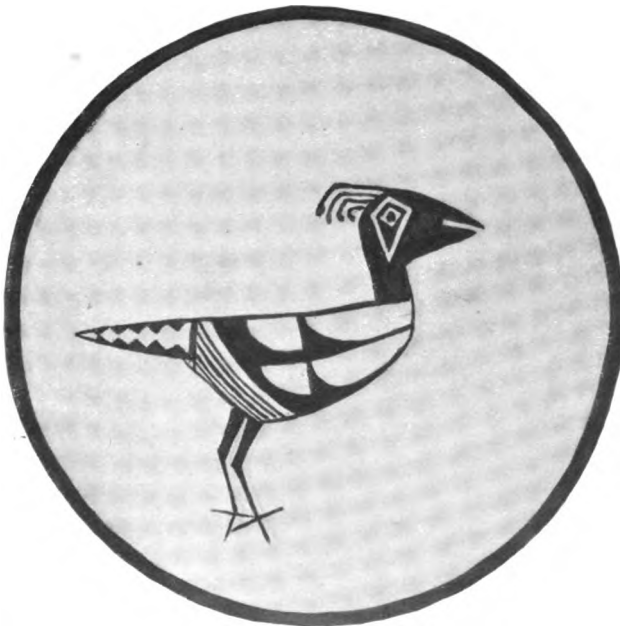


FIG. 2. BIRD F. RED AND WHITE WARE. DIAMETER 8 INCHES. OSBORN RUIN







1



2

FIG. 1.—PROBLEMATICAL ANIMAL. BLACK AND WHITE WARE. 15 BY 6 INCHES. OSBORN RUIN  
FIG. 2.—PROBLEMATICAL ANIMAL. RED DECORATION. OSBORN RUIN





1



2

FIG. 1.—GRASSHOPPER. RED FIGURE. DIAMETER 5 INCHES. OSBORN RUIN

FIG. 2.—FROG. DIAMETER 10 INCHES. OSBORN RUIN



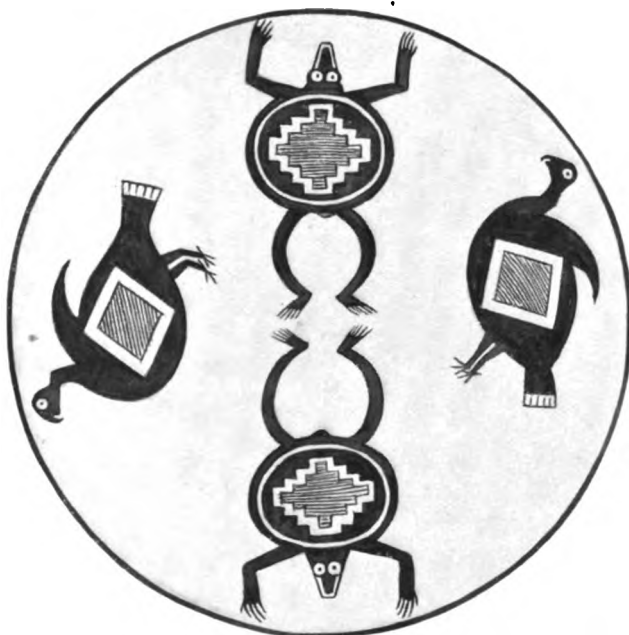
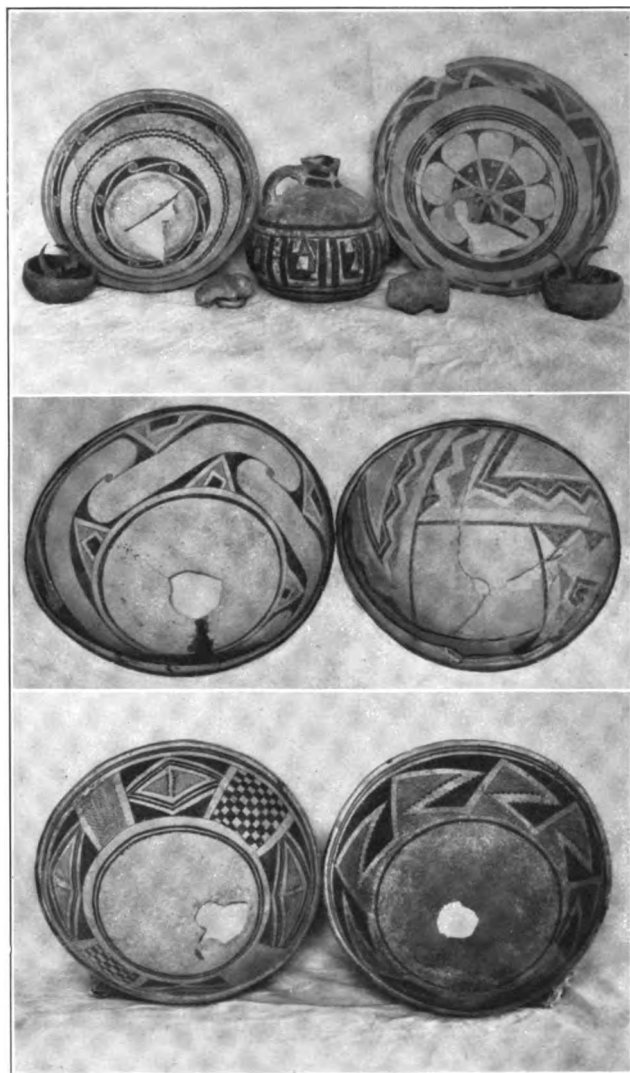


FIG. 1. FROGS AND BIRDS. BLACK AND WHITE WARE. DIAMETER ABOUT 12 INCHES  
OLDTOWN RUIN



FIG. 2. FISHES. BLACK AND WHITE WARE. 11 BY 4½ INCHES





GEOMETRICAL DESIGNS. DIAMETER  $\frac{1}{7}$  NATURAL SIZE





SMITHSONIAN MISCELLANEOUS COLLECTIONS  
VOLUME 65, NUMBER 6

EXPLORATIONS AND FIELD-WORK OF THE  
SMITHSONIAN INSTITUTION  
IN 1914

(WITH ONE PLATE)



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# EXPLORATIONS AND FIELD-WORK OF THE SMITHSONIAN INSTITUTION IN 1914

(WITH ONE PLATE)

During the year 1914 explorations and field-work were continued in various parts of the world under the direction or with the cooperation of the Smithsonian Institution. The more important are here reviewed, chiefly in the words of the participants therein. They include geological, zoological, botanical, anthropological, and astrophysical lines of investigation.

Three government branches of the Institution are represented in this report: the National Museum, although having no funds set aside for this purpose, avails itself wherever possible of opportunities to engage in natural history investigations and to add to its collections; the Bureau of American Ethnology is occupied largely with field-work among the Indians themselves, the annual report of that Bureau covering this work in detail; and the Astrophysical Observatory, in connection with its regular work of studying the physical properties of the sun and their effects on the earth, undertakes expeditions in this country and abroad for purposes of observation and investigation.

These various lines of field-work have tended to increase knowledge in the sciences and have added much valuable material to the collections of the National Museum and the Bureau of American Ethnology. The Institution was prevented from participating in many other expeditions only by its limited funds.

## GEOLOGICAL EXPLORATIONS IN THE ROCKY MOUNTAINS

In continuation of his previous geological researches in the Rocky Mountains of Canada and Montana, Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, spent a week during the field season of 1914 at Glacier, British Columbia, where he assisted Mrs. Walcott (née Mary M. Vaux) in measuring the flow of the Illecillewaet and Asulkan glaciers, photographs of which are shown in plate 1 and text figures 1 and 2.

From Glacier, Dr. Walcott proceeded to White Sulphur Springs, Montana, for the purpose of studying the ancient sedimentary Pre-paleozoic rocks of the Big Belt Mountains. These explorations were made on the eastern and southern slopes of this range, and

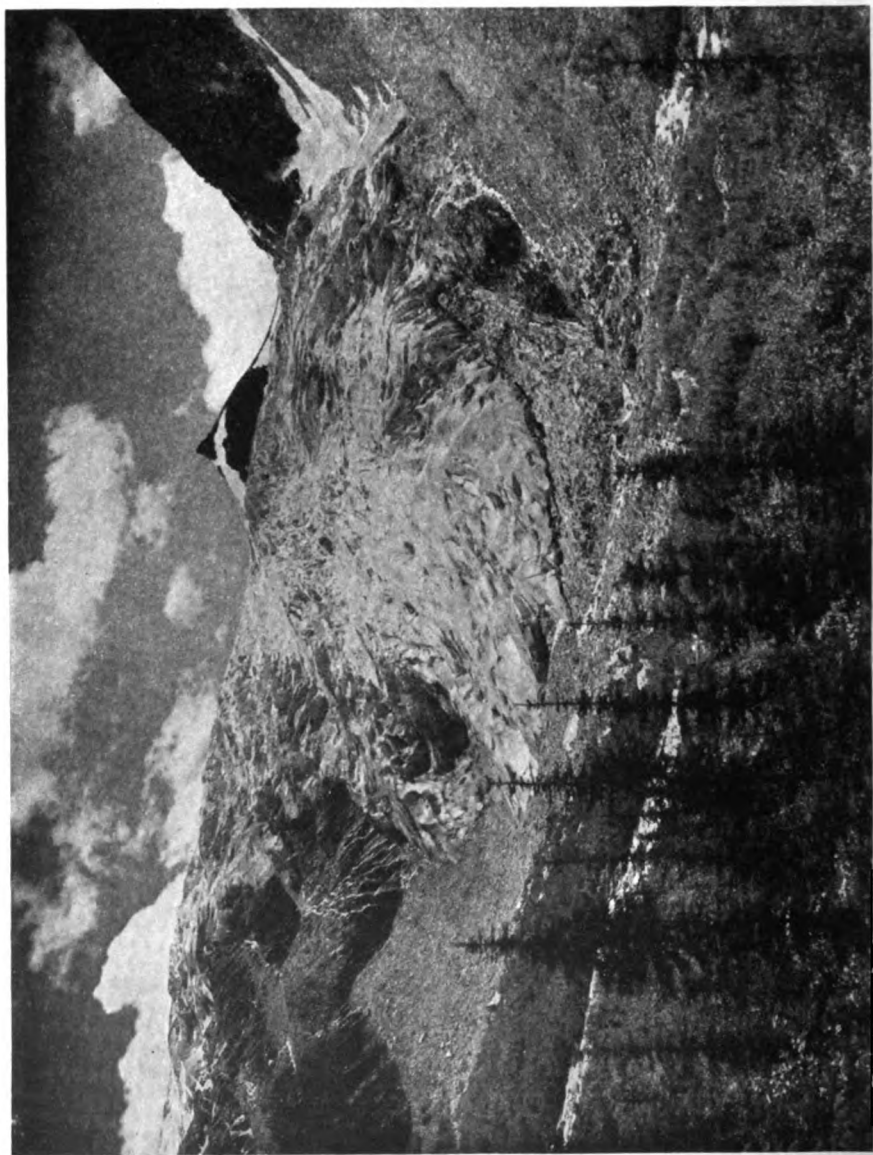


FIG. 1.—View of Illecillewaet Glacier from the north, showing the lower cascading portion and the bare rocks at its foot, which have been uncovered by the melting back of the ice for several hundred feet during the past five years. Photograph by Mary Vaux Walcott.

SMITHSON



a moraine





FIG. 2.—View from the foot of Asulkan Glacier, looking down the valley toward Illecillewaet Valley, through which the Canadian Pacific Railway passes. A ridge of the Selkirks is shown in the distance. Photograph by Mary Vaux Walcott.



FIG. 3.—Hard sandstones which rest on the granite at the base of the Belt Mountain rocks. These sandstones form cliffs along the canyon, about five miles above Neihart, Montana. Photograph by Walcott.

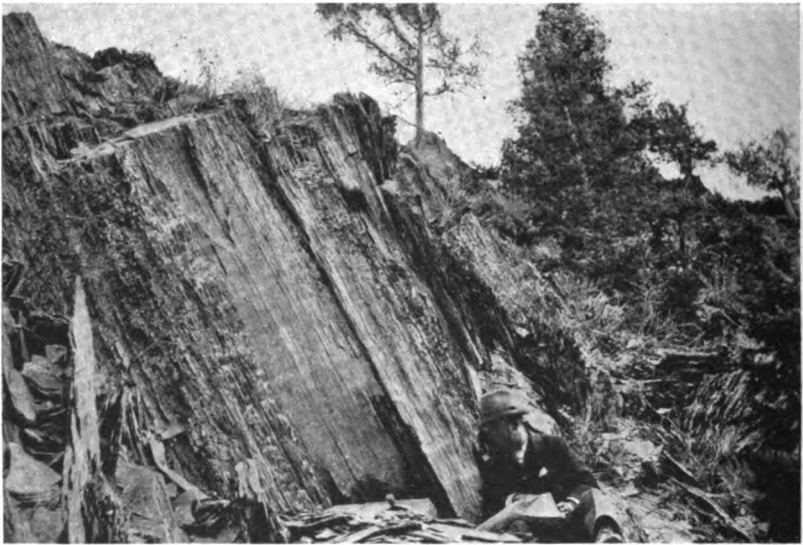


FIG. 4.—Slaty shales in which the Prepaleozoic crustacean fossils were found near the mouth of Deep Creek Canyon, Big Belt Mountains, 16 miles east of Townsend, Montana. Photograph by Walcott.



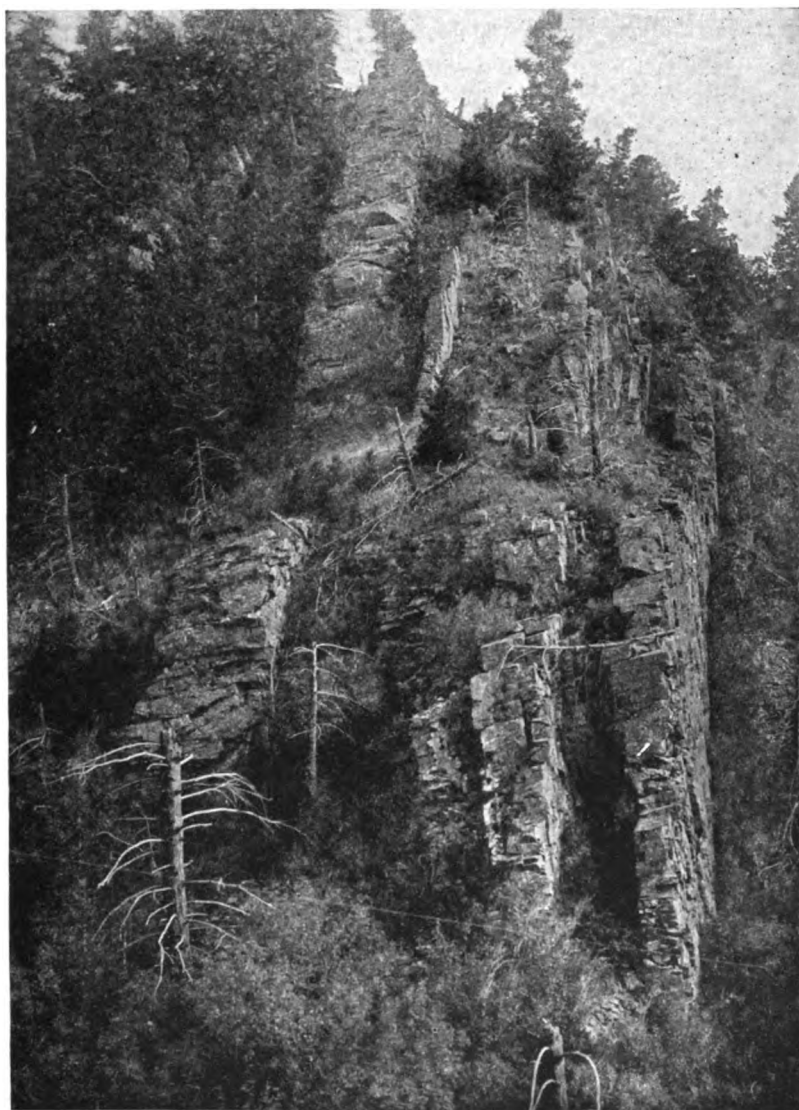


FIG. 5.—Vertical layers of hard sandstone that occur in the formation beneath the shales, illustrated by fig. 4, and above the limestones carrying the algal remains that occur higher up in Deep Creek Canyon. Photograph by Walcott.

then extended to the south on the Gallatin, Madison, and Jefferson rivers.

It was found that the Prepaleozoic sedimentary rocks were exposed by the uplift of the granite mass forming the summit of Mount

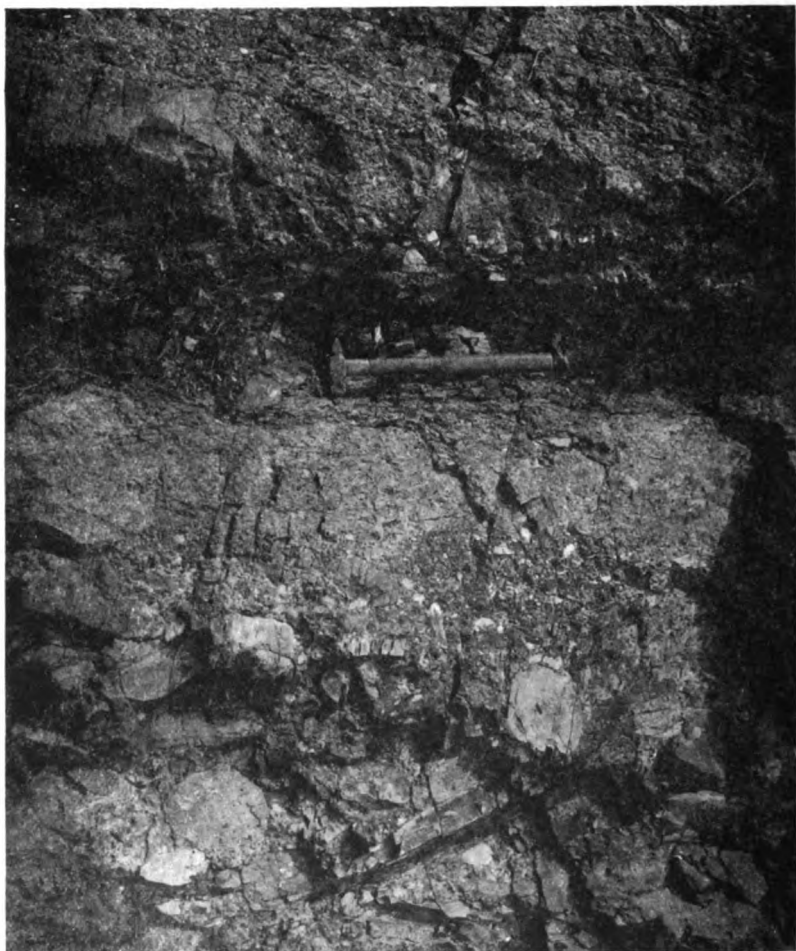


FIG. 6.—Conglomerate in the sandstones illustrated by fig. 5, where there are boulders and pebbles derived from the limestones beneath. This indicates that the limestones were raised above the surface of the water, so that they were broken up by weathering, and fragments of them carried by streams into the near-by lake and embedded in the sand. Photograph by Walcott.

Edith of the Big Belts, in such a way that the thickness of the sandstones, limestones, and shales could be readily measured in the numerous sections exposed in the canyons worn by waters descend-

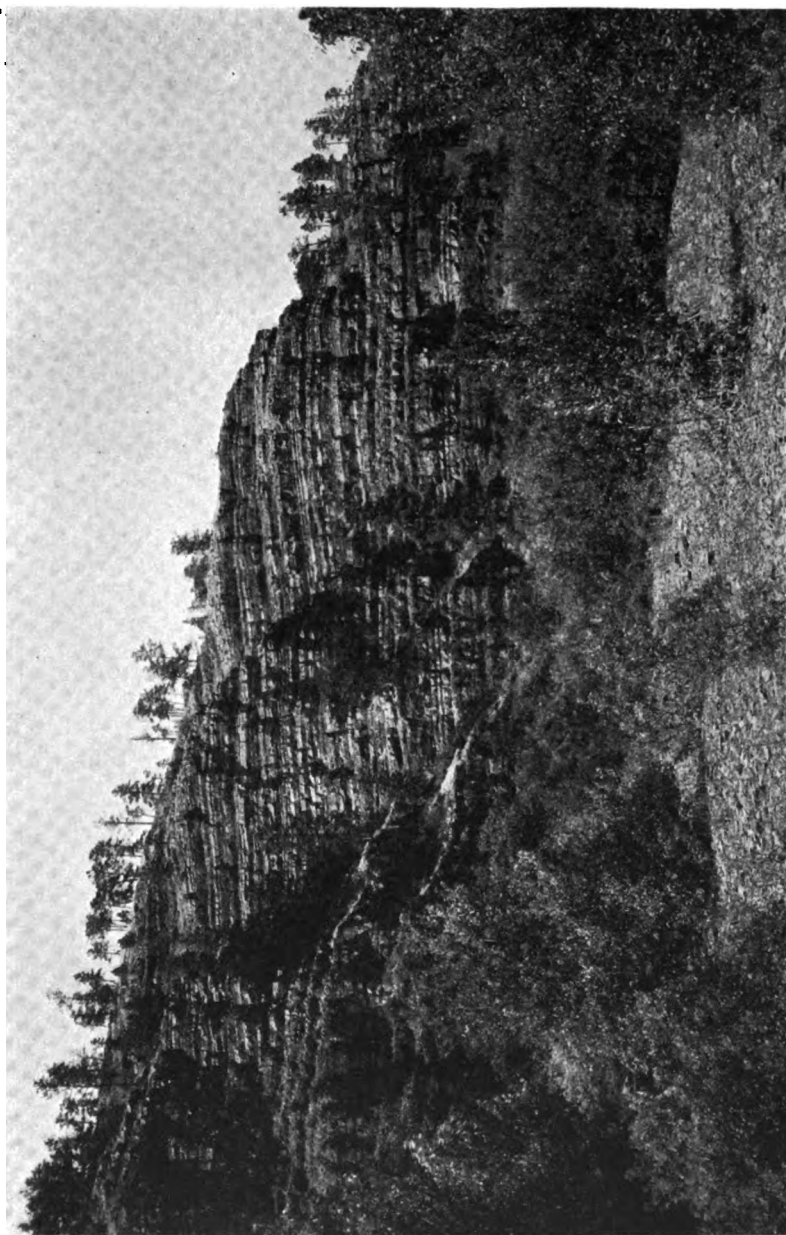


FIG. 7.—A cliff formed by hard layers of sandstone with thin layers of shale between. These rocks occur above the shales illustrated in fig. 4. Photograph by Walcott.



FIG. 8.—Curious pattern in limestones supposed to result from algal deposits.



FIG. 9.—Etched section through the center of a double concretionary-like form which may have been influenced in its growth by algal deposits, and which contains numerous fossil bacterial remains.

ing from the higher points to the valley surrounding the range. Nearly five miles in thickness of rock were measured, and in the limestone belts reefs of fossil algal remains were studied and large collections made with the assistance of Mrs. Walcott and Charles E. Resser and sent on to Washington.

It was found that the algal remains were deposited very much in the same manner as those that are now being deposited in many fresh-water lakes, and that many of the forms had a surprising

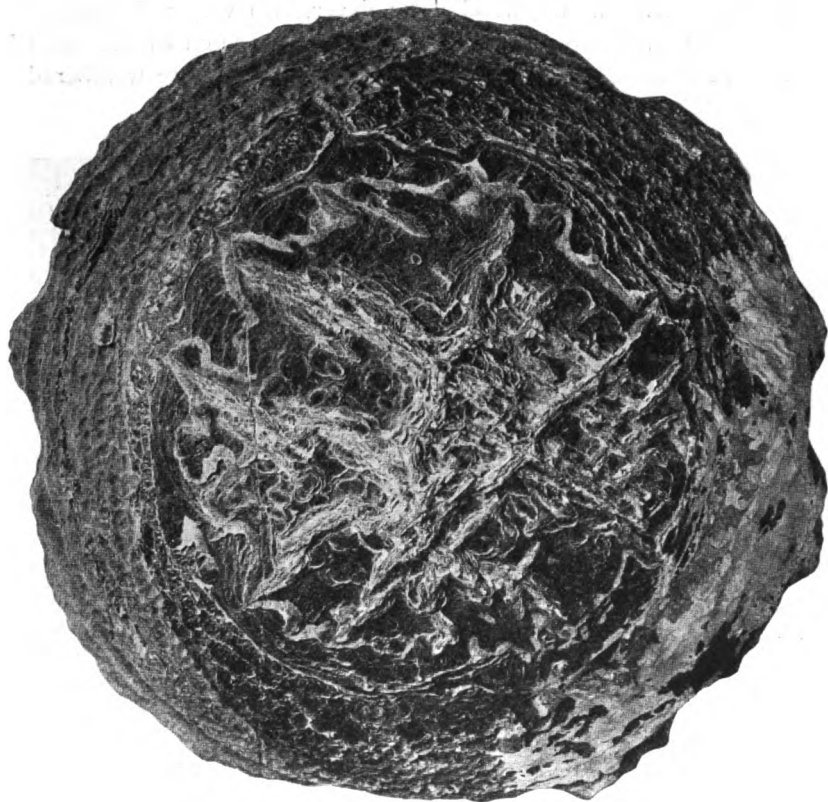


FIG. 10.—Upper surface of a lens-shaped concretionary-like form which resembles some of the siliceous deposits of the Yellowstone Park hot springs. This form has been named *Gallatinia pertexa*. Numerous cells such as occur in the Blue-green algæ have been found in thin sections of this type of supposed algal deposit.

similarity to those being deposited in the thermal springs and pools of the Yellowstone National Park.

In the lower portion of Deep Creek Canyon southeast of the city of Helena, a deposit of siliceous shale was examined, where some years ago Dr. Walcott discovered the remains of crab-like animals

suggesting in form the fresh-water cray fishes found in the streams and ponds all over the world.

These fossils are the oldest animal remains now known, and the algal deposits which occur at intervals for several thousand feet below the shales containing the crustaceans, are the oldest authentic vegetable remains. It is also most interesting that two types of bacteria have been found in a fossil state in the rock in association with the algal remains.

On the north side of the Gallatin River, two very rich beds of algal remains were found, many of which, on account of the fossil being silicified and embedded in a softer limestone, were weathered out in relief, as shown by figure 8.



FIG. 11.—Calvert Cliffs, Chesapeake Bay, Maryland, showing outcrop of Miocene bryozoan beds. Photograph by Bassler.

#### STUDIES IN COASTAL PLAIN STRATIGRAPHY AND PALEONTOLOGY

Dr. R. S. Bassler, curator of paleontology, U. S. National Museum, was engaged during the month of June, 1914, in a study of the Tertiary paleontology and stratigraphy of the Atlantic Coast Plain with special reference to the bryozoan faunas. This work was for the purpose of making further collections and of determining the stratigraphic relations of these bryozoan faunas for publication in the Monograph of North American Early Tertiary Bryozoa, now in course of completion by Ferdinand Canu of Versailles, France, and Dr. Bassler.

Starting at Chesapeake Beach, Maryland, and continuing southward through Virginia, North Carolina, South Carolina, Georgia, and Alabama, all the classic localities were visited, as well as many not so well known. The celebrated Calvert cliffs along Chesapeake Bay yielded a rich Miocene fauna and here many specimens were easily secured by searching the débris along the beach as shown in the accompanying photograph (fig. 11).

At Wilmington, North Carolina, an especially fine lot of material suitable for biological studies was collected from the city rock quarry, through the generous cooperation of the contractor in charge of some convict laborers. In South Carolina, the curator was taken through the swamps to the fossil localities by Mr. Earle Sloan, former



FIG. 12.—Cypress swamp, Santee River basin, South Carolina. Photograph by Bassler.

State geologist, without whose expert knowledge of the region little could have been accomplished. Here in many cases the rock exposures consisted of nothing but small outcrops brought to the surface by the "knees" of the cypress trees (fig. 12), but weathering of the hard rock had been so complete that many specimens could be had free of surrounding matrix. In Georgia and Alabama an abundance of material collected carefully with regard to its geologic position was secured and the stratigraphic position of several hitherto unplaced faunas was determined. The results of this field work from both the paleontologic and stratigraphic standpoints were so satis-

factory that the completion of a monograph upon the subject is now assured.

#### EXPLORATIONS FOR FOSSIL ECHINODERMS IN WESTERN NEW YORK

The field explorations conducted under the supervision of Mr. Frank Springer, associate in paleontology in the U. S. National Museum, for the purpose of adding to the Springer collection of fossil echinoderms, were devoted mainly to careful work in the Silurian rocks exposed along the new Erie Canal in western New York. Here Mr. Springer's private collector, Frederick Braun, spent some weeks during the summer of 1914 searching especially the waste material thrown out in excavations for the canal. The most valuable specimens from this part of New York occur in the Rochester shales of Niagaran age, which weather rapidly into mud upon exposure to the elements. It was necessary, therefore, that the new outcrops exposed along the canal be examined at once if valuable returns were to be expected, and Mr. Braun was directed accordingly to concentrate his efforts upon this area. The results were highly satisfactory, as numerous specimens of crinoids and cystids were found, a number of them having, as is rarely the case, root, stem, and crown preserved. These specimens were prepared for exhibition during the fall of 1914 and form a valuable addition to Mr. Springer's unique collection of fossils.

#### FOSSIL COLLECTING AT THE CUMBERLAND CAVE DEPOSIT

In continuation of the work of the previous year in the Pleistocene cave deposit near Cumberland, Maryland, Mr. J. W. Gidley, assistant curator of fossil mammals, again visited this locality in May and June of 1914. This expedition was highly successful and has added over 400 specimens to the fine collection from this deposit, including a good skeleton of the large extinct peccary, a partial skeleton of the wolverine, and several nearly complete skulls of these and other species. Among the latter are five good skulls of extinct species of the black bear and eight skulls, in more or less good state of preservation, of the extinct peccary.

Some new forms not before found in this deposit were obtained, the most important being a new species of badger and a second type of extinct peccary known as *Mylohyus*. The collection of the 1914 expedition far exceeds, both in numbers and quality of specimens, those previously taken from this deposit. The cubic space excavated was also much greater than before, yet at the end of the season's work the deposit showed no signs of immediate exhaustion of fossil-



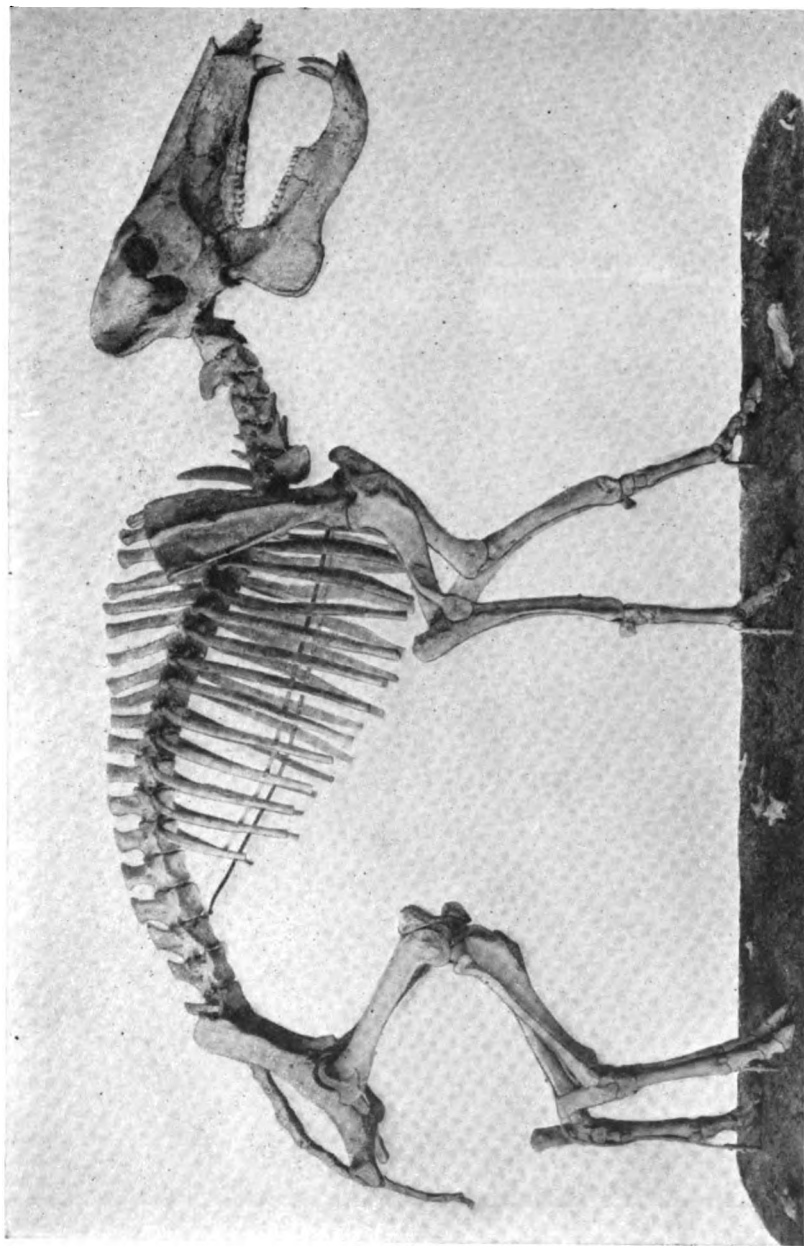


FIG. 13.—Skeleton of extinct Peccary from the Cumberland cave deposit. About  $\frac{1}{8}$  natural size.

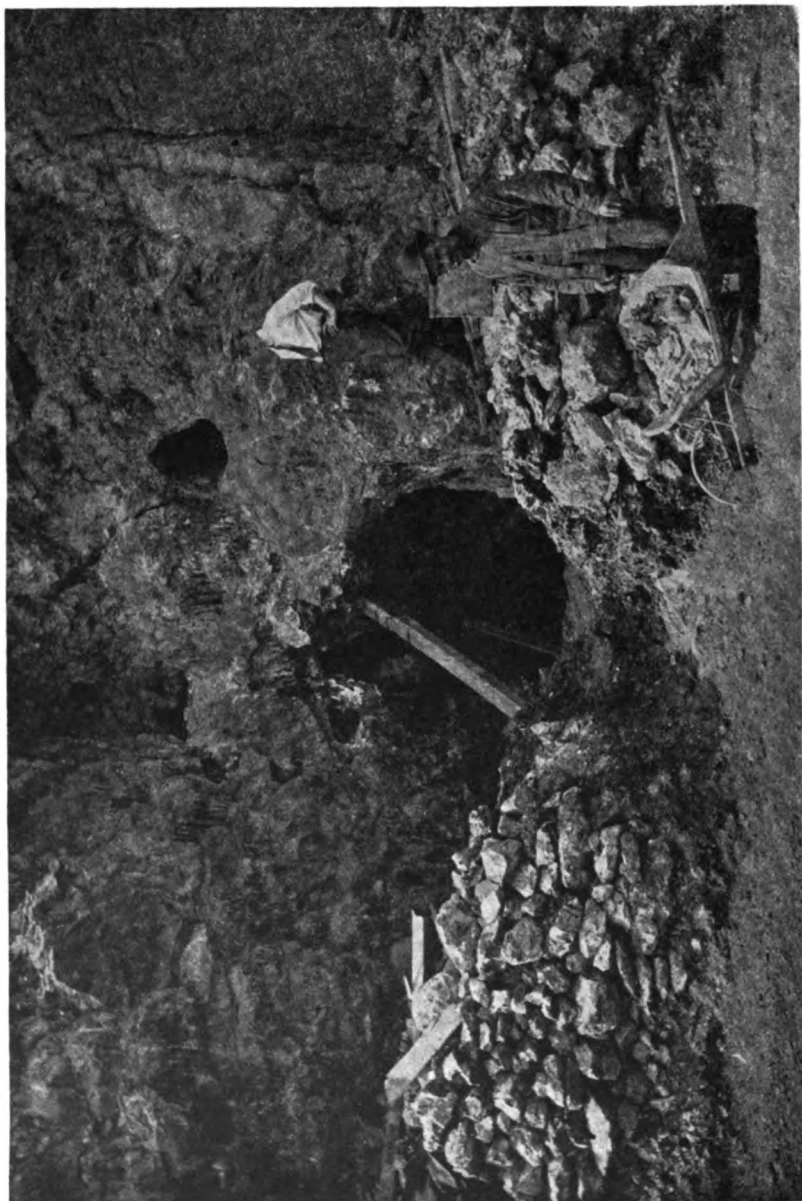


FIG. 14.—View in railroad cut showing excavation made by U. S. National Museum party, 1914 expedition.  
Photograph by Armbruster.

bearing material, and it is expected that this work will be further continued during the coming summer.

In addition to the fossil bearing cave clays and breccias filling the old cavern, it was necessary to remove several tons of overhanging stalactitic rock and anciently fallen blocks of limestone. This added to the more cave-like appearance of the opening, as may be seen by comparing figure 14 herein with figure 18<sup>1</sup> published in last year's account of the work at Cumberland.

The results of the work of the 1914 expedition have greatly increased the possibility of accurate determinations of the fauna represented in this very interesting cave deposit and it is hoped the

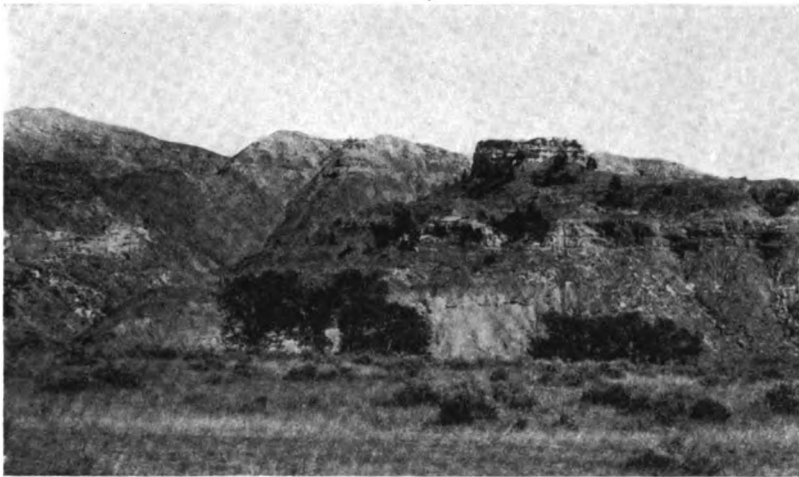


FIG. 15.—Bad Land exposures near the mouth of Dog Creek, Montana. Photograph by U. S. Geological Survey (T. W. Stanton).

proposed further exploration will furnish added material of even greater importance.

#### HUNTING VERTEBRATE FOSSILS IN MONTANA

During the summer of 1914 Mr. Charles W. Gilmore, assistant curator of fossil reptiles in the National Museum, spent three weeks searching for fossil vertebrate remains in the Judith River formation in north central Montana.

By arrangement with the U. S. Geological Survey Mr. Gilmore worked in cooperation with one of their field parties. From their camp as a base of operations he conducted an exploration of the exposures along Dog and Birch creeks, near Judith post office, in

<sup>1</sup> Smithsonian Misc. Coll., Vol. 63, No. 8, 1914, p. 16.

the hope of collecting identifiable material to supplement the fragmentary fossil specimens secured by earlier expeditions. Abundant evidence of the presence of fossil remains was found, but much of the material was fragmentary and only a few specimens were shipped

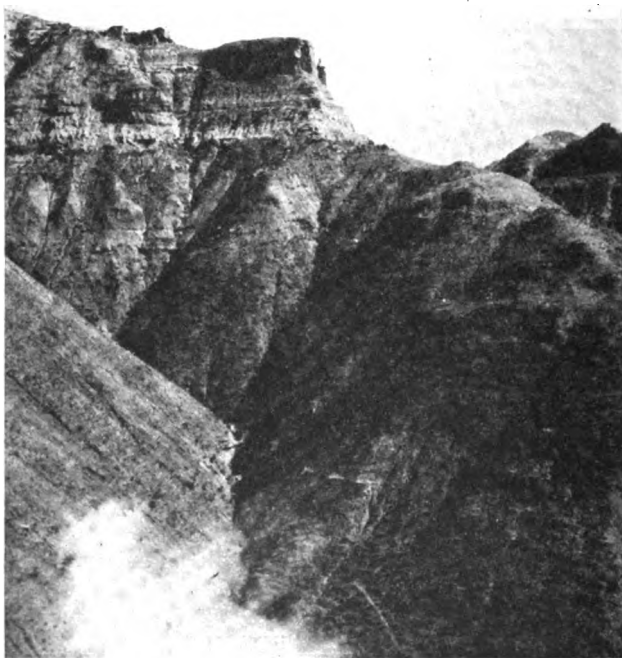


FIG. 16.—Judith River and Claggett formations as exposed on Dog Creek, Montana. Bird remains found at base of cliff in middle distance. Photograph by Gilmore.

to Washington. From a paleontological standpoint the most noteworthy discovery was the fragmentary remains of a fossil bird related to *Hesperornis* found by Dr. T. W. Stanton on Dog Creek (fig. 16). It came from practically the same locality as the type of *Coniornis altus* Marsh, and is of importance as showing these bird

remains as occurring in the upper part of the Claggett formation, whereas heretofore it was thought that *Coniornis* had come from the lower part of the Judith River formation.

Incidental to this paleontological work a collection of Indian skeletons was obtained for the National Museum. These remains, consisting of parts of eleven individuals, were found in shallow graves in the crevices of a large block of Eagle sandstone that had been faulted up and which forms a conspicuous landmark in the valley just above the mouth of Dog Creek. A picture of this rock is shown in figure 15.

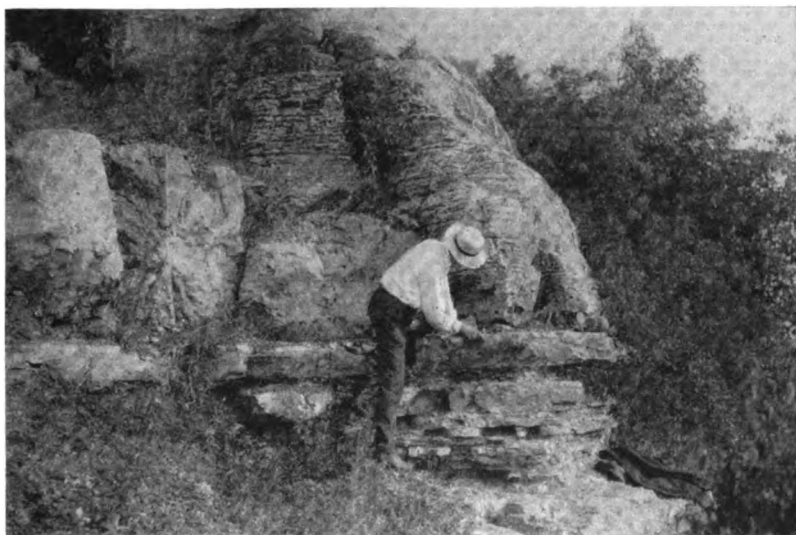


FIG. 17.—Unconformity between Lower Chazy (Stones River) and Lower Black River (Lowville) strata at Columbia, Tenn. Dr. Ulrich is pointing to the undulating line which lies one to three inches below the top of the ledge indicated. Photograph by Bassler.

#### STRATIGRAPHIC STUDIES IN CENTRAL TENNESSEE

Dr. E. O. Ulrich, associate in paleontology, and R. S. Bassler, U. S. National Museum, were engaged for several weeks during the summer of 1914 in a study of debated points in the stratigraphy of the Central Basin of Tennessee under the joint auspices of the U. S. Geological Survey and the U. S. National Museum. The particular objects of the work were: first, to determine accurately the division line between the Chazy and Black River groups, and second, to secure additional information on the black shale problem.

The well known marble beds of east Tennessee and associated shales and sandstones of Upper Chazyan age with a thickness of over 3,000 feet have never been found in central Tennessee, or in fact in any area west of the Appalachian Valley. The first problem was therefore to determine either the corresponding rocks in the more western areas or, if such strata were wanting, to discover the unconformity representing this great thickness. After some days of careful stratigraphic work it was learned that the Lower Chazyan or Stones River rocks of central Tennessee are succeeded directly by the lowest Black River or Lowville formation. In other words,

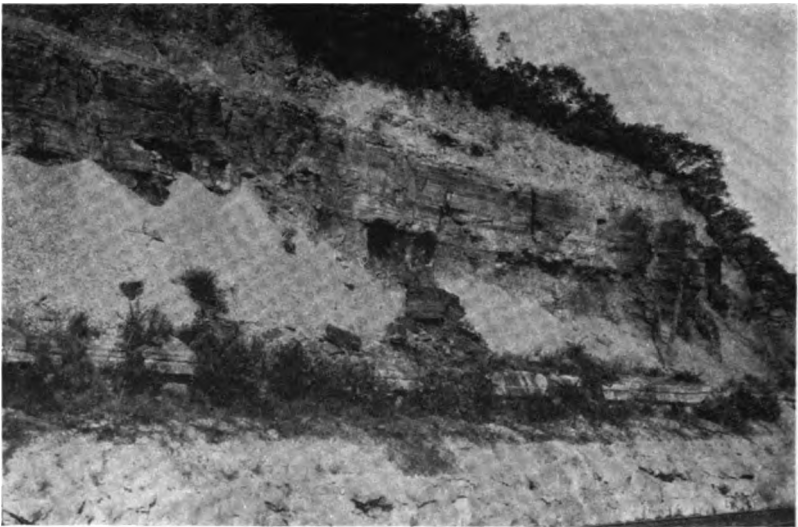


FIG. 18.—Exposure of black shale and underlying Silurian strata at Bakers, Tenn. Photograph by Bassler.

all of the Upper Chazyan rocks are wanting entirely, and central Tennessee therefore was presumably a land area during the time of deposition of the celebrated east Tennessee marbles. The unconformity between the two groups of strata is shown in figure 17, where it may be seen as an undulating line in a single ledge of limestone.

The second problem entailed further work on the determination of the age of the widespread Chattanooga black shale, which previously had been considered to be middle to late Devonian. In recent years this determination had been questioned and facts had accumulated showing it to be of younger age. Two features of considerable

significance in this problem were the discoveries in northern Tennessee, where the shale is well exposed, as shown in figure 18, that (1) this black shale passes without a discernible break into the overlying Mississippian (Kinderhook) shales, and (2) that the fossils of this overlying shale are of late instead of early Kinderhook age. As a result of this work good collections of several well preserved faunas were added to the Museum collection.

#### GEOLOGY OF CERTAIN AREAS IN EASTERN PENNSYLVANIA

Dr. Edgar T. Wherry, assistant curator of the division of mineralogy and petrology, by arrangement with the U. S. Geological Survey, spent a month during the summer of 1914 in the study of the Pre-Cambrian, Cambrian, Ordovician, and Triassic formations of the Reading and Allentown quadrangles in eastern Pennsylvania. In the former area particular attention was directed toward the lithologic character and fossil content of the Conococheague and Beekmantown limestones, and the mapping of these and other post-Cambrian formations, which had been begun the previous season, was practically completed.

In the Allentown region brief visits were paid to several localities to secure data for the text of the Allentown-Easton folio, which is in course of preparation. The criteria for recognition of the various Pre-Cambrian formations, especially the metamorphosed sediments, were worked out in detail, and sections of the Triassic and Paleozoic beds measured.

#### GEOLOGICAL STUDIES IN NEW YORK STATE

Dr. J. C. Martin, assistant curator of geology, has spent some time completing minor details in the preparation of a report on "The Pre-Cambrian Rocks of the Canton, N. Y., Quadrangle," to be published by the New York Geological Survey.

The examination of this area involved the working out of structural and genetic problems of a high degree of complexity, the solution of which demanded methods of great accuracy and detail.

Among the results obtained may be mentioned, particularly, the determination of the close analogy between tectonic elements of widely differing degrees of magnitude, and the recognition of a type of major isoclinal folding with steep-dipping axes, paralleled, so far as known, only by occurrences in Sweden. In addition there were obtained many new data with reference to the origin and relations of multiple injection gneisses of more than one generation,

as well as the sequence of acid and basic igneous rocks and the complex interrelations of extensive garnet gneisses, amphibolites, and other Grenville and post-Grenville crystalline formations.

#### EXPEDITION TO BORNEO AND CELEBES

Mr. H. C. Raven, who, through the generosity of Dr. W. L. Abbott, has been working in Borneo since the summer of 1912,

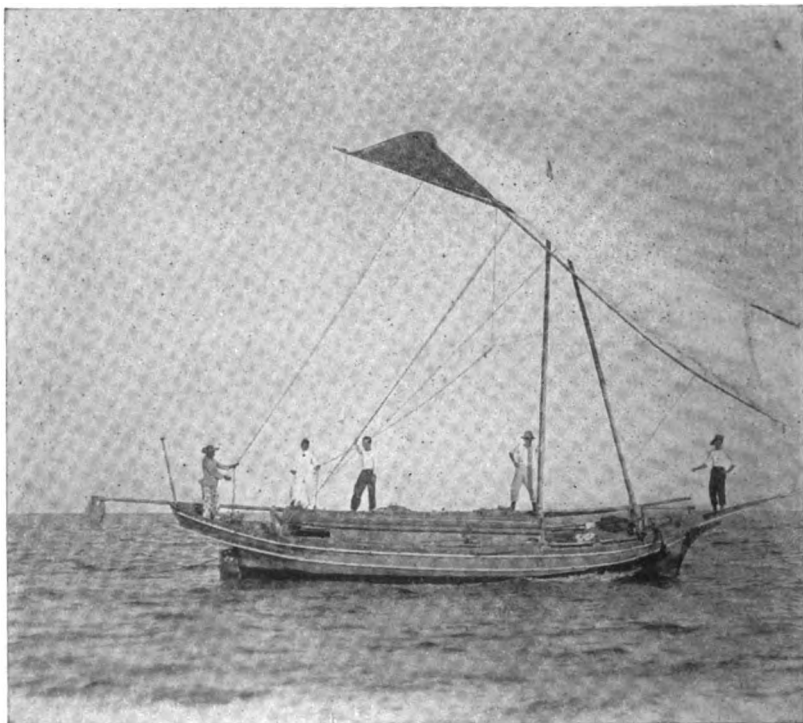


FIG. 19.—The "Bintang Kumala," used by Mr. Raven in Borneo from July, 1912 to July, 1914. Photograph by Raven.

continued his explorations, with Samarinda, Dutch East Borneo, as headquarters. During the early part of the year he worked on the coast north of Samarinda, and later he ascended the Mahakam River. The results were satisfactory, though the region of the upper Mahakam proved somewhat disappointing on account of the practical extermination by the natives of all mammals large enough to be used as food. About the middle of July Mr. Raven finished his Bornean exploration and crossed the Macassar Strait to the Island



of Celebes, where he intends to remain for an indefinite period. This change of base was not so simple a matter as might be supposed, as is shown by the following passage from a letter dated at Tanjong Lango, Celebes, August 28, 1914:

As I wrote before, when I returned from the interior of Borneo to Samarinda, I had to have my boat, the "Bintang Kumala," hauled out. It needed repairs and drying after having been in the water constantly for two years or more. The Assistant Resident stationed at Samarinda at this time went up



FIG. 20.—Camp at Karang Tigau, Celebes, August, 1914. Photograph by Raven.

along the coast to Beraoe and I asked him to bring me two or three sea-faring natives to act as a crew to cross with me to Celebes. He was unable to get them. I tried, but could find no Bajans or Soeloes who would go, but finally found, near Samarinda, three Bugginese who claimed they could sail. So when the boat was ready we started, and to my great disappointment I found my crew entirely incapable, running the boat ashore before we had gotten fairly started. There was nothing to do but to return to Samarinda. I thought of having the boat either towed or lifted across to Donggala by the steamer making that run at intervals of two weeks; this I found would cost more than one hundred and fifty dollars, and after crossing I would stand a big chance of having the same trouble in getting a reliable crew. Just at that time a small two-master schooner came into Samarinda and my attention was called to it

by a European who considered my boat unsafe to cross in. I had a look at the schooner and found it to be strongly built and in pretty good condition, 54 feet long and 12 feet beam, drawing about 4 feet of water. It is made entirely of iron-wood.

After considering, I decided the best plan would be to buy the schooner, and as the owner was willing to sell, we came to terms. He bought my boat for three hundred and fifty guilders and I was to buy the schooner for thirteen hundred and fifty guilders, but found that I could not own and sail a boat under the Dutch flag unless I had been holder of citizen's papers for a full



FIG. 21.—Beraoe Malays at Maratua Island, southeast Borneo.  
Photograph by Raven.

year. According to the Dutch law, coasting under a foreign flag is prohibited. Thus my only way was to make a contract of "Bond Loan," stating that I had loaned thirteen hundred and fifty guilders to Hadji Mohamad Arsad and as security he gives into my absolute custody his schooner, which he may redeem only during the thirteenth month after date by paying the sum of thirteen hundred and fifty guilders and must accept the schooner in any condition in which she may be at that time. He can never claim damages, inasmuch as the loan equals the value of the schooner; also that if Hadji Mohamad Arsad breaks the contract and takes back the schooner before the end of the twelve months after date (July 4, 1914), he must pay not only the sum of the loan

but also a fine of five hundred guilders. To find a crew for this boat was not difficult, and she is far better to handle than the smaller one and no more expensive to man, probably cheaper. Having crossed to Celebes in this boat, I should not care to do it in the smaller one, for Macassar Strait is 140 miles wide and over a thousand fathoms deep. A current running against the wind sometimes makes bad weather. Nearly all the coast of Celebes is rocky, with deep water close in to shore, so that in case of storm we sometimes have to run out to sea rather than chance going on rocks. In such cases it is exceedingly difficult in a small boat to keep anything dry.



FIG. 22.—Dyak woman, Segah River, Borneo. Note ear ornaments and tattooing on thighs. Tattooing is difficult to photograph on account of its coloring. Photograph by Raven.

On reaching Celebes Mr. Raven immediately began his field work, with what success may be inferred from further passages from the letter of August 28.

The country here is a great contrast to that of Borneo and mammal life not nearly so plentiful. There is a mining company located at Paleleh working gold, and they have cut trails back into the jungle. There are several Europeans and they allowed me to use their trails. I went inland about four or five miles over the mountains and made camp at the edge of the Paleleh River,

which is a small brook and at this season nearly dry, with steep mountains or hills on all sides.

My traps I placed not far from the river, which at this dry season should be as good as any place. Nearly everywhere the shore is planted with coconuts and oftentimes clearings are made on the hill slopes, but inland the original forest remains unmolested, though it is not open forest like that of eastern Borneo. There is much underbrush, composed principally of a variety of almost worthless rattan.

Thus far I have collected specimens of Babirusa [a pig with peculiar erect tusks curved backward above forehead at extremities], two females with

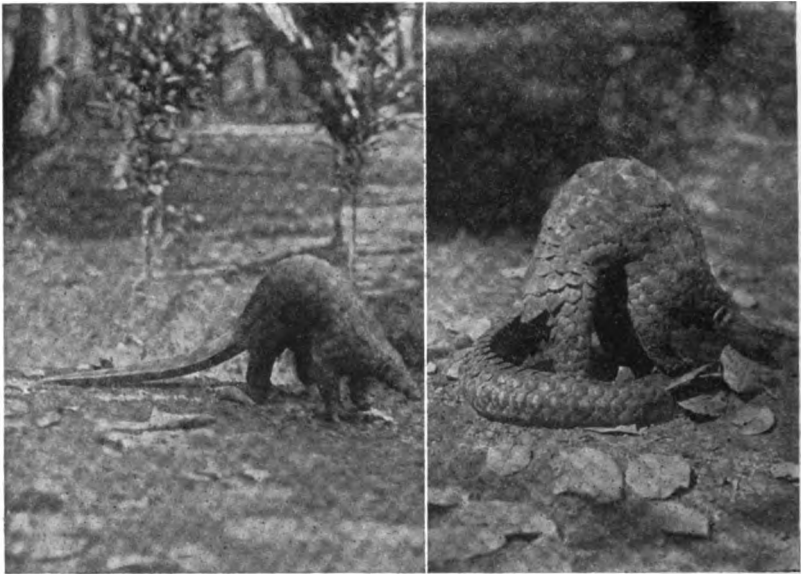


FIG. 23.—Two attitudes of Pangolin. Length of animal: head and body, 26 inches; tail, 22 inches. Mahakam River, Borneo. Photograph by Raven.

skins and some fine skulls of males. Also a peculiar black pig with hard cartilaginous conical nodules on its nose and hard jowel patches; a marsupial and two species of squirrels. I have also seen a reddish squirrel running on the ground, but have not gotten one; also I have seen a small carnivore. Of rats I have six or seven species, and possibly there are more. I have also some bats. The ants do not seem to destroy as many rats here as in Borneo; this will prove a great advantage in collecting.

According to natives, Sapi-utan [a dwarf buffalo peculiar to Celebes] and Rusa [deer] in certain localities are abundant, though I have yet seen none. The natives also say there are many wild water-buffalo which have escaped from captivity years ago.

Reptiles appear to be common and the miners at Paleleh killed a python which they say *measured* 10 meters.

Black macacus monkeys are generally common and at a distance look like black dogs. About the edges of the forest I have seen many birds, but in the deep forest I have seen very few.

Photographs I can probably send via Gorontalo. The chief difficulty in making pictures here is the dirty, warm water.

No specimens from Celebes have yet been received in Washington; but all the Bornean material is at hand, forming a very important addition to the National Museum collection. It includes 310

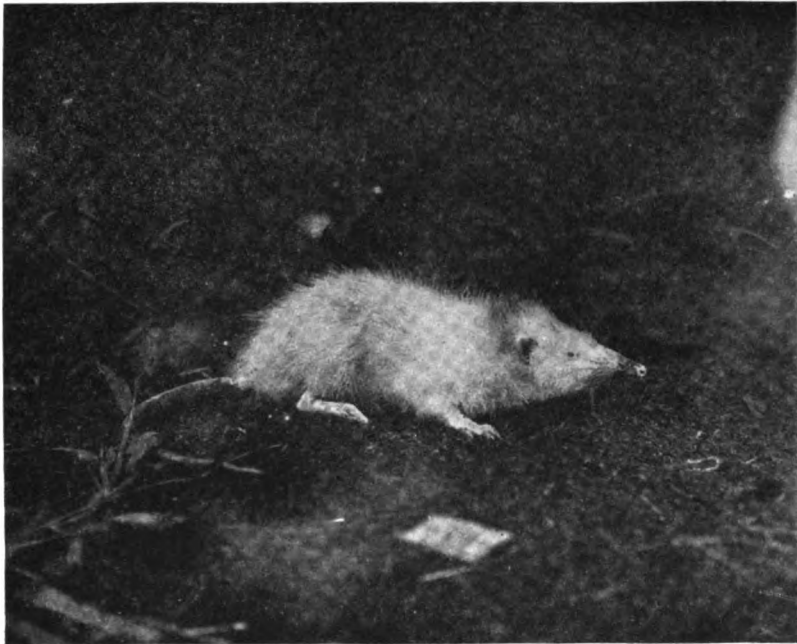


FIG. 24.—Gymnura, an animal related to the European hedgehog, though its body is covered with coarse hair instead of spines. Length: head and body, 14 inches; tail, 11½ inches. Samarinda, Borneo. Photograph by Raven.

mammals taken in 1914, making total of 1,613; and 261 birds taken in 1914, making total of 1,440.

Some of the photographs alluded to by Mr. Raven are here reproduced.

#### EXPEDITIONS TO THE FAR EAST

Mr. Arthur de C. Sowerby has continued his explorations in Manchuria and northeastern China. Interesting specimens received from him are two wapiti bucks and a roe deer. A recent letter announces the capture of two bears and a peculiar rabbit.

Mr. Copley Amory, Jr., a collaborator of the National Museum, joined the party accompanying Captain J. Koren to the northeast coast of Siberia. This party sailed from Seattle about June 25, and was last heard from at Nome, Alaska, on July 19. It is Mr. Amory's intention to explore such territory as may be practicable from Nijni Kolymsk as a winter base. He will give special attention to mammals and birds. Figure 25 is from a photograph of Captain Koren's boat.



FIG. 25.—Captain Koren's vessel which took exploring party to Siberia.

#### THE "TOMAS BARRERA" EXPEDITION IN WESTERN CUBA

During the months of May and June, 1914, an expedition under the joint auspices of the Smithsonian Institution and the Cuban Government was made to Cape San Antonio and the Colorados Reefs of northwestern Cuba. Through the great generosity of Senior Raoul Mediavilla of Havana, the use of the large and well-equipped schooner "Tomas Barrera" was given the expedition free of all cost of charter. This schooner, of the class locally known as a "Vivero," contains a large well or tank admitting sea water, a feature which proved of greatest value for stowage of living specimens. A carefully selected crew, familiar with the intricate channels of the reefs, was also provided by Senior Mediavilla. Besides the schooner, two power launches were also taken, one especially equipped for dredging in moderate depths.

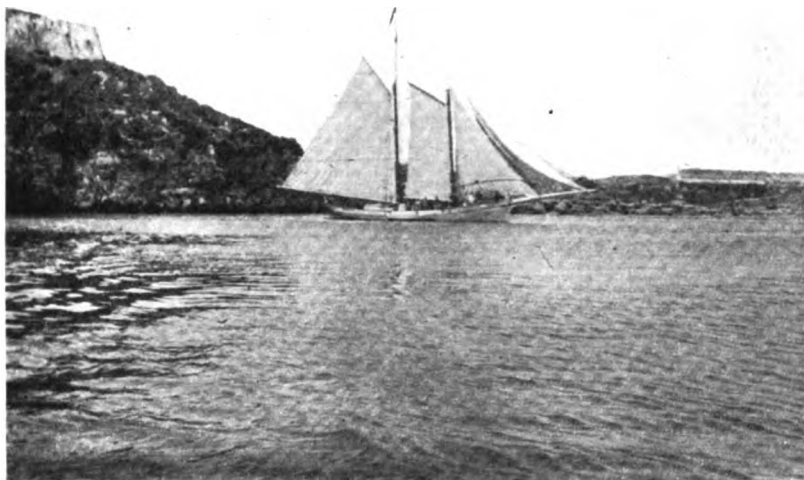


FIG. 26.—The "Tomas Barrera" in Havana Harbor.



FIG. 27.—Setting traps for fish and crustaceans off Cape Cajon.



FIG. 28.—The Patron of the "Tomas Barrera" with a huge sponge, only a portion of which appears above water, secured by diving. One of the dredges used by the party is shown hanging over the edge of the launch.



FIG. 29.—Henderson and Greenlaw collecting Cerions.





FIG. 30.—The big land Crab of Cuba.



FIG. 31.—Track for charcoal burners' carts, extending miles into the interior at Cape San Antonio, along which were obtained hundreds of specimens of all kinds of animals.

The main object of the expedition was to make as complete as possible a biological survey of the waters of western Cuba, especially of the extensive Colorados Reefs, heretofore wholly unexplored by naturalists, and to obtain fine specimens for the exhibition series of the National Museum. Another purpose of the visit to this region was to investigate closely the fauna of certain high mountains of the northern ranges of the *Sierra de los Organos* to gather material from those inaccessible localities. The chief interest of the Cuban Government was a study of food-fish life of the reefs, and to that end



FIG. 32.—Bartsch collecting the rare landshell, *Urocoptis dautzenbergiana*, of which several hundred were obtained in the space shown in the photograph.

Sr. Lesmes of the Cuban Fish Commission was detailed by President Menocal to accompany the party.

Careful preparation was made for intensive field work and a full equipment of dredges, traps, submarine electric lights, chemicals for stupefying marine animals, etc., was taken.

Besides extensive dredging operations carried on daily, shore parties visited the two great mountains, Pan de Guajabon and Pan de Azucar, and also spent some time in the Viñales region, about Guane, and in the low-lying country about La Fe, and finally spent several days collecting in the heavily forested region about Cape San Antonio. From these shore stations an immense number of specimens were collected, including many species new to science.



FIG. 33.—The Cuban Maja (*Epicrates angulifer* Bibron). Frequently met with while hunting landshells in the mountain country.

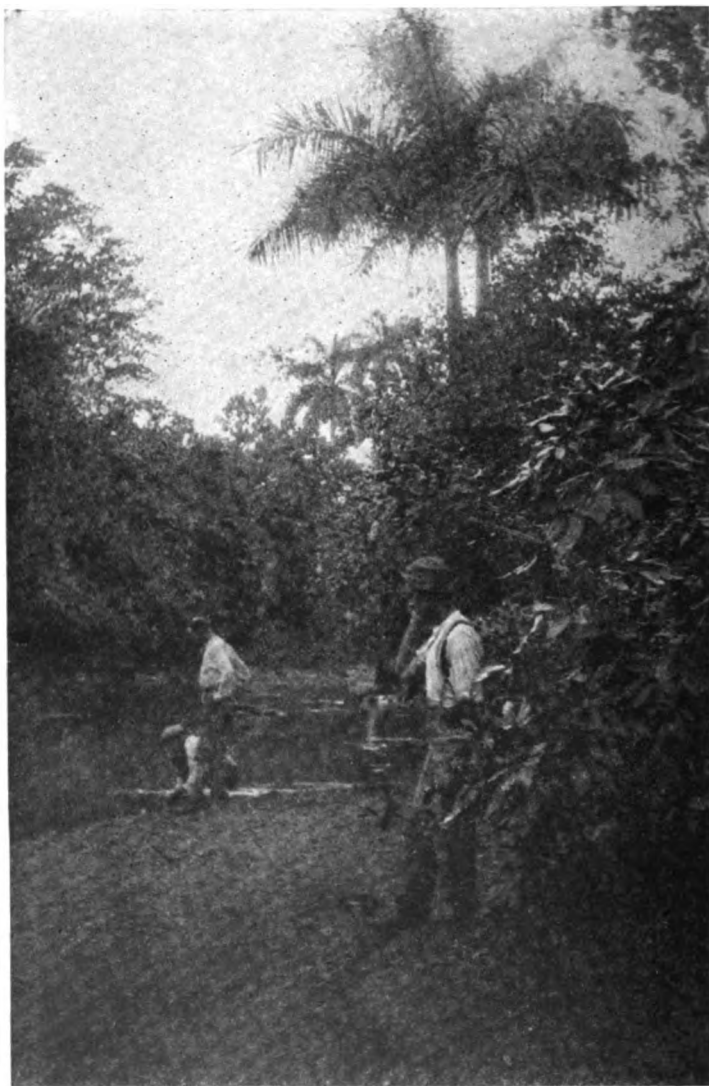


FIG. 34.—River at La Mulata on the trail to Mt. Guajaibon, where fresh-water animals of various kinds were collected. Henderson and Clapp at water's edge, and Rodrigues at right.

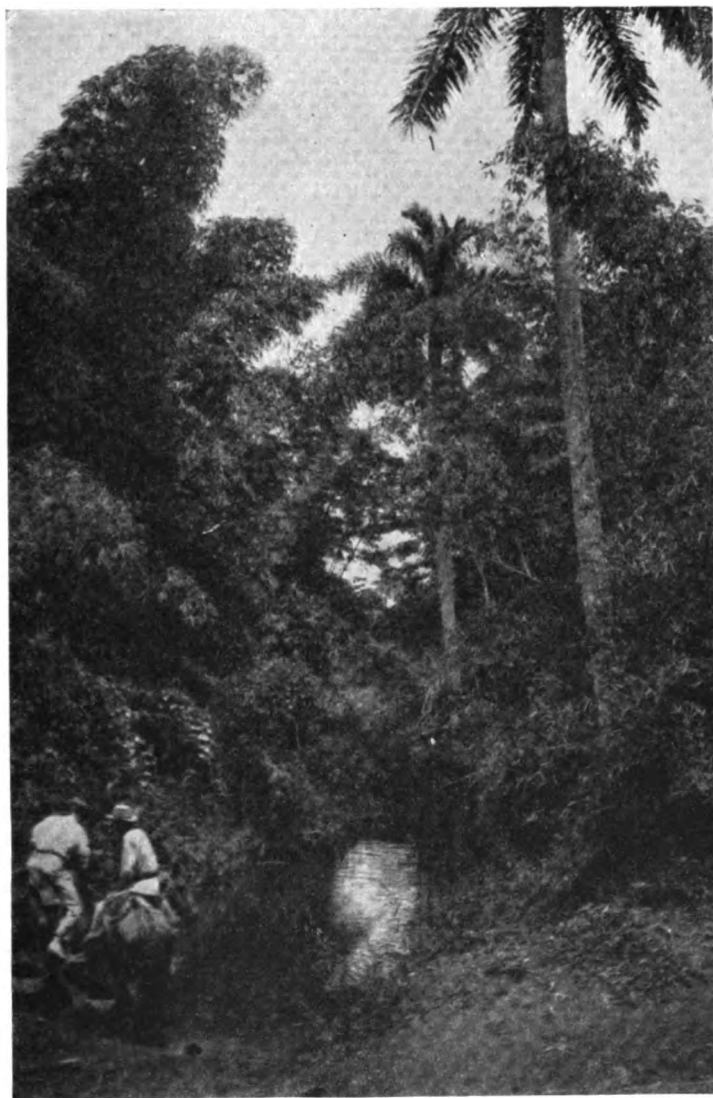


FIG. 35.—Typical jungle scene and a favorite place for fresh-water mollusks.

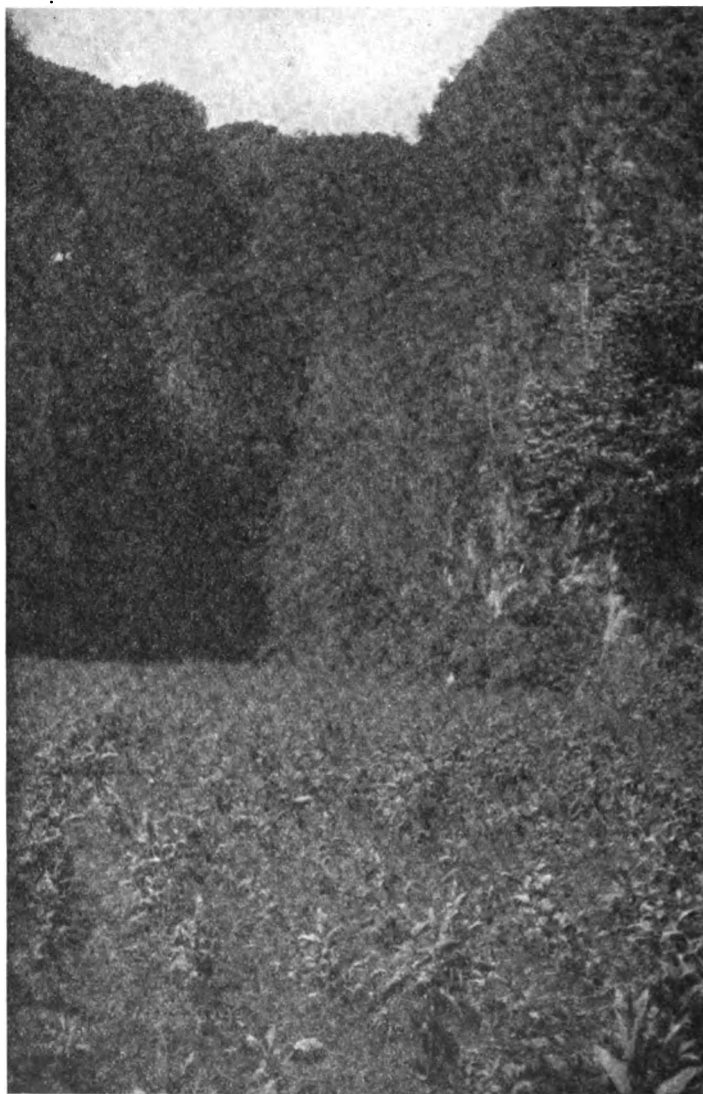


FIG. 36.—Cove of Delight in the Viñales Range. A famous collecting ground for land mollusks.

The expedition met with signal success and returned a great quantity of interesting material to the Museum, which is now in the hands of specialists for final report. Splendid collections in all of the phyla of marine organisms, including protozoa, sponges, corals,

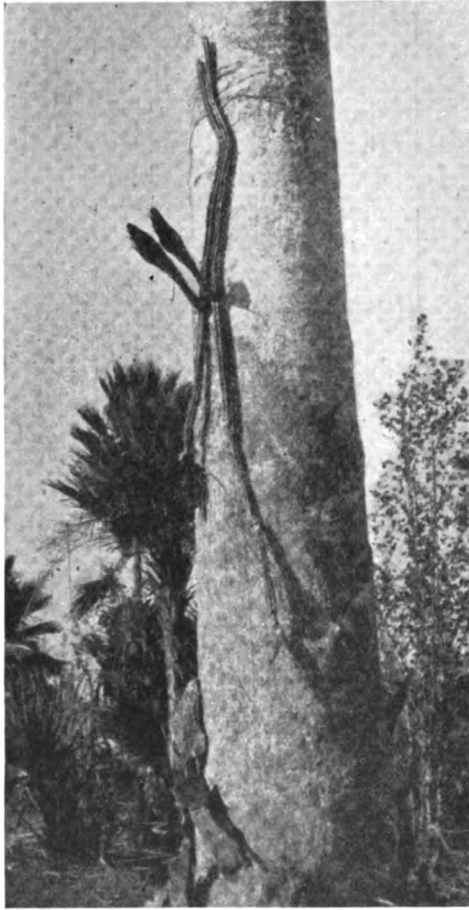


FIG. 37.—A Cuban cactus in flower.

gorgonians and medusæ and other cœlenterates, annulates, echinoderms, crustaceans and mollusks, were made. The usual hydrographic data were also carefully kept, and bottom and water samples were taken at the various stations. Whenever possible collections of fresh water organisms were secured. The wonderful development of molluscan life furnished by far the greater part of our

catch, though the efforts of the expedition were by no means solely devoted to this end. The vertebrates, as well as the lower organisms, added materially to our catch. Among plants, special attention was given to the cacti, of which a number of very interesting forms were secured. A general account of the expedition, "The Log of the Tomas Barrera," by Mr. Henderson, is almost completed, and detailed reports on results of the expedition, by various specialists, are to follow.

The party consisted of Mr. John B. Henderson, member of the Board of Regents of the Smithsonian Institution; Dr. Paul Bartsch, curator of marine invertebrates, U. S. National Museum; Dr. Carlos de la Torre of the University of Havana; Mr. George H. Clapp of Pittsburgh, Pa.; Mr. Charles T. Simpson of Little Rivers, Fla., formerly of the Museum staff; and of Mr. Gill, the Museum colorist, and Mr. Victor Rodrigues, preparator at the University of Havana.

It is expected that this expedition to western Cuba will be followed by a series of similar explorations in other parts of the Antillean regions looking primarily to the enrichment of the Museum collection in the fauna of the West Indies, in order that we may gain a clearer understanding of the faunas and faunal relationship of the West Indies.

#### EXPERIMENTS WITH CERIONS IN THE FLORIDA KEYS

Brief accounts have been published in previous Smithsonian exploration pamphlets<sup>1</sup> of the Bahama Cerion colonies planted on the Florida Keys by Dr. Paul Bartsch of the U. S. National Museum, under the auspices of the Carnegie Institution of Washington. As regards the development of the new generation of these shells in a new environment, it was stated last year that "judging from the young collected which were born on these keys (fig. 38), the first generation will be like the parent generation, unless decided changes should take place in the later whorls, which have not as yet been developed." On Dr. Bartsch's visit to the colonies in April, 1914, however, adult specimens of the new generation were found at several localities, and these fully developed adults enable him to state that a decided change has taken place. So pronounced are the departures from the parent generation that the specimens would undoubtedly be considered by one unfamiliar with the history of the material as distinct species and not closely related to the parent

<sup>1</sup> Smithsonian Misc. Coll., Vol. 60, No. 30, pp. 58-62; Vol. 63, No. 8, pp. 27-30.





FIG. 38.—Young *Cerions* grown on Loggerhead Key, Tortugas, Florida.

stock. Also the first generation shows a wider range of variation than the parents.

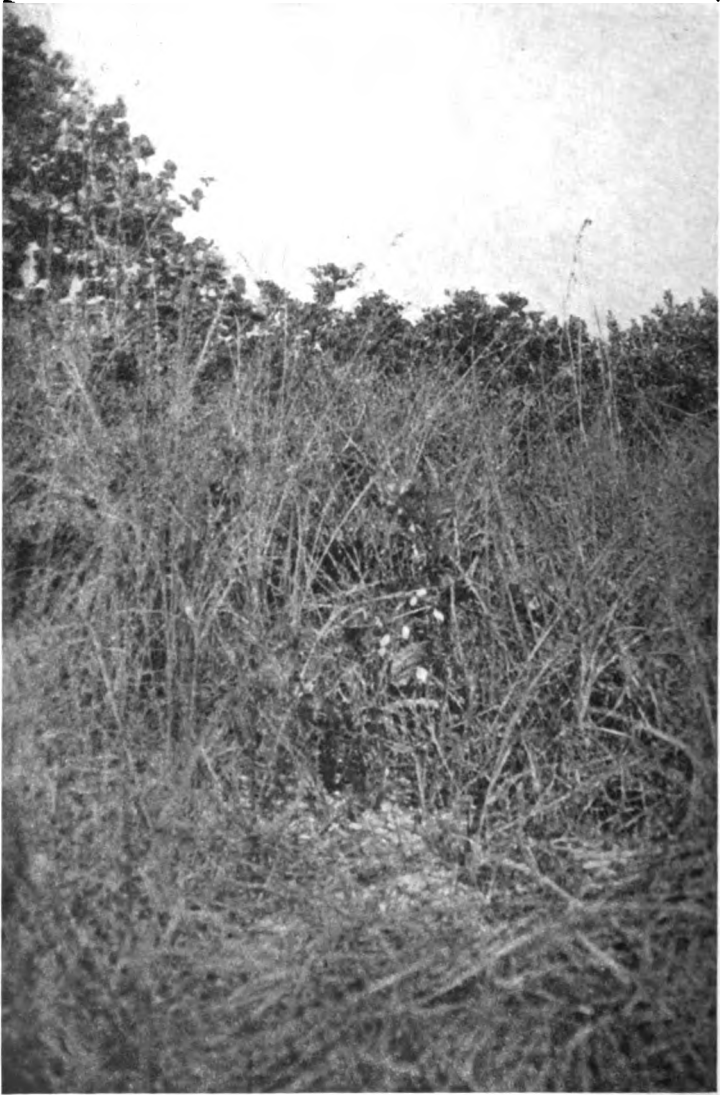


FIG. 39.—Bahama Cerions on Duck Key, Florida.

This departure from the parent generation is shown in the shape, coloration, and sculpture of the shells (fig. 40). The tendency of the whole lot is toward elongation, and toward the attenuating and

rounding of the base. There is one type of variation in which the ribs are almost obsolete and very widely spaced. Another is darker and narrower, and the ribs are much more crowded together. All these various modifications in the new generation show that the

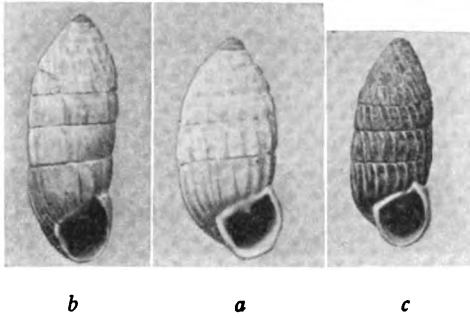


FIG. 40.—*a*, A typical planted specimen; *b* and *c*, two changes shown in the first generation of Florida-grown specimens.

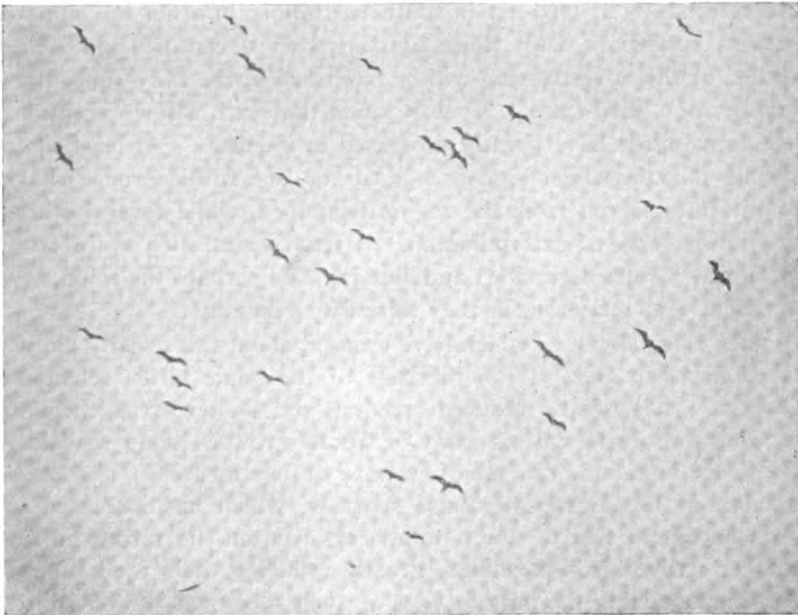


FIG. 41.—Man-o'-war birds suspended on motionless wing on upthrust of air above southeast corner of Fort Jefferson, Tortugas, Florida.

somaplastm in the Cerions experimented with has been affected by the new environment in which they were developed.

Further even more interesting results bearing on heredity and environment are expected from the continuation of Dr. Bartsch's studies with the Cerions. A full account of the work so far done and the results obtained will shortly be published by the Carnegie Institution of Washington.

During Dr. Bartsch's trip in 1913, a record was kept of the birds observed on the Florida Keys, and as this list proved of considerable interest to ornithologists, the observations were continued in 1914. Some 46 species were noted, including 19 not observed the previous year. A detailed account appears in the Year Book of the Carnegie Institution of Washington for 1914, pp. 192-194.

#### BIRD STUDIES IN ILLINOIS

Incidental to continued work on preparation of manuscript of the unpublished volumes of "Birds of North and Middle America" (Bulletin 50, U. S. National Museum), Mr. Robert Ridgway made a careful study of bird-life in southern Illinois, in order to compare present conditions with those existing half a century ago. The results of this investigation will be published in the May-June, 1915 number of "Bird-Lore." It was found that with a few exceptions the native birds have greatly decreased in numbers. At least three species (the passenger pigeon, wild turkey, and ruffed grouse) have totally disappeared from the region examined, while several others are on the verge of extermination. A few species, such as the crow blackbird (bronzed grackle) and blue jay, and perhaps the robin, are, apparently, as numerous as they were fifty years ago.

The principal causes which have brought about this greatly diminished bird-life are: (1) in the case of the game birds, relentless shooting; (2) greatly reduced breeding and shelter areas, through clearing of forests, cutting away of woody growths along roadsides and fence-lines and drainage of swampy or marshy areas; (3) introduction of the European house sparrow, which has increased to such an extent that it now outnumbers, even on the farms, all the smaller native birds combined, greatly reducing their food supply, and monopolizing the nesting sites of such species as the blue bird, purple martin, wrens, swallows, and other birds that nest in cavities or about buildings; (4) invasion of the woods and fields by homeless house cats, and destruction of eggs and young (often the parents also) of ground-nesting species by "self-hunting" bird dogs (setters and pointers); and, probably, (5) spraying of orchards.

## CACTUS INVESTIGATIONS IN PERU, BOLIVIA, AND CHILE

Dr. J. N. Rose, associate in botany, U. S. National Museum (at present connected with the Carnegie Institution of Washington in the preparation of a monograph of the Cactaceæ of America), spent nearly six months in travel and field work on the west coast of South America during the summer and fall of 1914, visiting Peru, Bolivia, and Chile. He made collections on the coast at the following places: Paíta, Pacasmayo, Saliverry, and Mollendo in Peru; Iquique, Antofagasta, Coquimbo, Los Vilos, Los Molles, and Valparaíso in Chile. As his chief work was to study and collect cacti, most of his time was spent in the interior deserts. A section was made through central Peru from Callao to Oroya, from sea level to the top of the Andes, the highest point reached being 15,665 feet. Cacti were found in the greatest abundance at an altitude of 5,000 to 7,500 feet; but the various species range from a few feet above sea-level to as high as 12,000 to 14,000 feet.

A second section was made across southern Peru, from Mollendo to Lake Titicaca via Arequipa. The highest point reached was 14,665 feet. Here also the cacti are found from near sea-level nearly to the top of the Andes; but the most remarkable display is on the hills surrounding Arequipa, at an altitude of from 7,000 to 8,500 feet. While the cacti are abundant in both these regions, they are, with only a few possible exceptions, quite distinct. Side trips were made from Arequipa to Juliaca and Cuzco, in Peru, and to La Paz, Oruro, and Comanche, in Bolivia.

On the pampa below Arequipa are found the famous crescent-shaped sand dunes. Each dune or pile of sand is distinct in itself, often separated some distance from any other dune, and occurring, too, on rocky ground devoid of other sand. The dunes are found on the high mesa some 5,250 feet above the sea. They form definite regular piles of sand, each presenting a front 10 to 100 feet wide and 5 to 20 feet high, nearly perpendicular, crescent shaped, and from the crescent-shaped ridge tapering back to the surface in the direction from which the wind blows. These piles of shifting sand go forward about 40 feet a year.

In Chile two sections were made into the interior—one from Antofagasta to Calama, and one from Valparaíso to Santiago. The first is through the rainless deserts of northern Chile, the whole region being practically devoid of all vegetation. The second is across central Chile, the hills and valleys of which are veritable

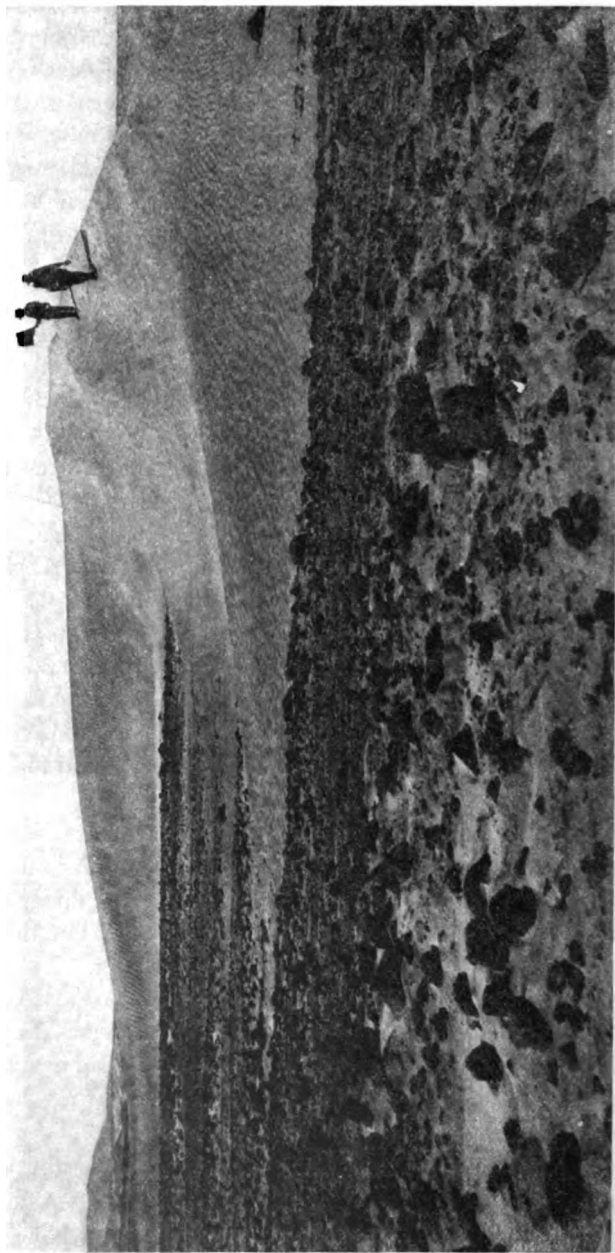


FIG. 42.—Showing the front of one of the crescent-shaped sand dunes characteristic of the high pampa between Mollendo and Arequipa, Peru. These dunes move forward about 40 feet a year.



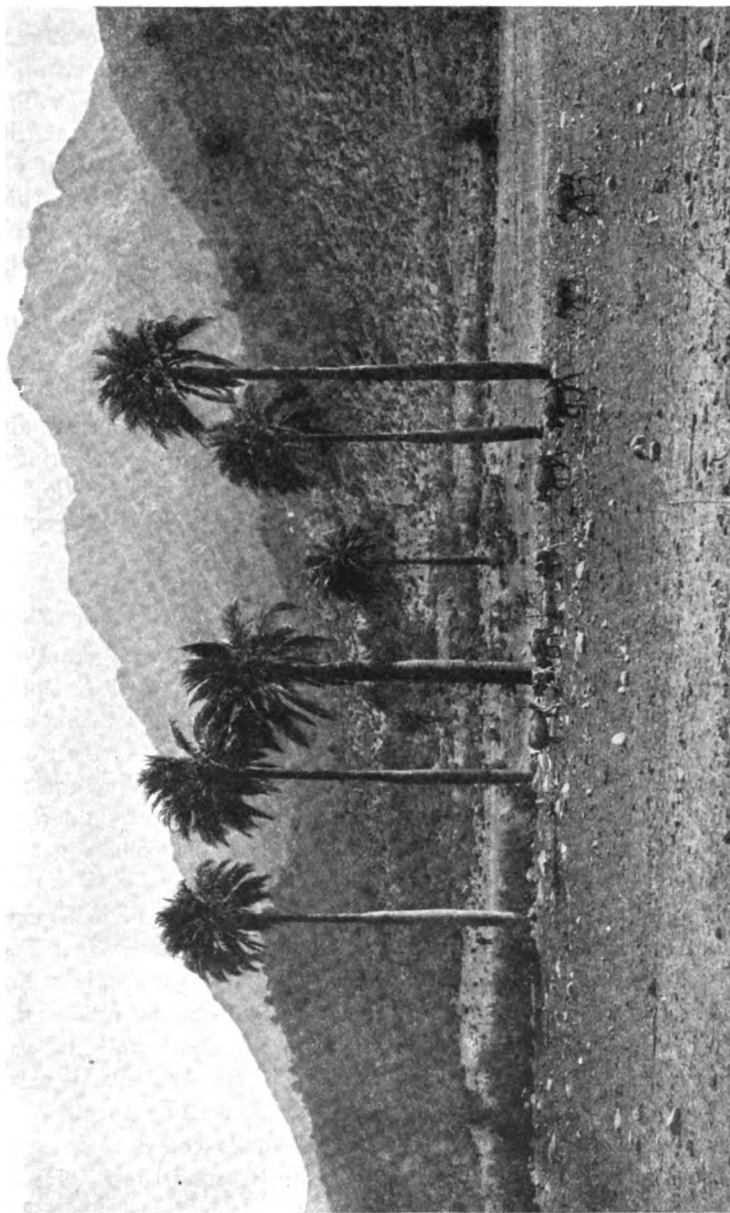


FIG. 43.—A group of palms, *Jubaea spectabilis* H. B. K., common in the Chilean valleys north of Santiago. From the sap of this palm is made a delicious syrup, "Miel de Palma," much prized by the people of this region.

flower gardens, the hills often being a mass of yellow. Various trips were made in the central valley of Chile and one journey along the Longitudinal Railway of Chile extended from Caldera to Santiago. Special trips were made for certain rare plants like *Cereus castaneus*, first collected in 1862 and not since observed until found by Dr. Rose; and *Cactus horridus* and *Cactus Berteri*, described in 1833, but long since discarded by Cactus students. In the central valley of Chile is seen that beautiful palm, the only one native of Chile, *Jubaea spectabilis* H. B. K., which often forms forests of considerable extent. From this palm is made the "Miel de Palma" so much used as a syrup on ships and at hotels.

Dr. Rose made extensive shipments of living cacti. Most of the material is of species new to American collections and quite a number have not before been in cultivation, while some are new to science. In addition, formalin and herbarium material was obtained in abundance. His collection represents over 1,000 numbers, consisting not only of cacti, but ferns, grasses, mosses, marine algæ, parasitic fungi, and other miscellaneous groups which Dr. Rose believed would be of help to various specialists.

#### BOTANICAL EXPLORATIONS IN NEW MEXICO AND TEXAS

During August and September, 1914, Mr. Paul C. Standley of the division of plants of the National Museum and Mr. H. C. Bollman of the Smithsonian Institution spent nearly five weeks camping in northern New Mexico at the Brazos Canyon in Rio Arriba County. This locality is about 30 miles south of the Colorado line and about half way across the state. While the trip was a private undertaking primarily for vacation purposes, a representative collection of the plant life of the region was made.

The Brazos Canyon is a gorge through which the Rio Brazos, a tributary of the Chama River, runs for several miles. Near Tierra Amarilla, where it flows into the Chama, the Brazos is a broad stream, with only a moderately rapid current. As one follows up its course the stream gradually becomes more rapid, and the valley narrower. Eight or nine miles west of Tierra Amarilla there rises on the north side of the valley a high mesa, with an abrupt escarpment of naked reddish rocks, and one finally comes to a gigantic fissure in the escarpment from which the Brazos issues. Here, for several miles, the stream runs through a deep gorge, bounded by bare, perpendicular granitic walls from two to three thousand feet high, in places less than a hundred yards apart. This chasm is



similar to the Taltéc Gorge, which receives so much attention from the tourists who travel over the line of the Denver and Rio Grande Railroad between Antonito and Durango, Colorado, and it is probably superior in size to that better known canyon. The Brazos, within its canyon, and for a couple of miles after leaving it, is a swift stream of considerable volume, rushing along over rapids or falling now

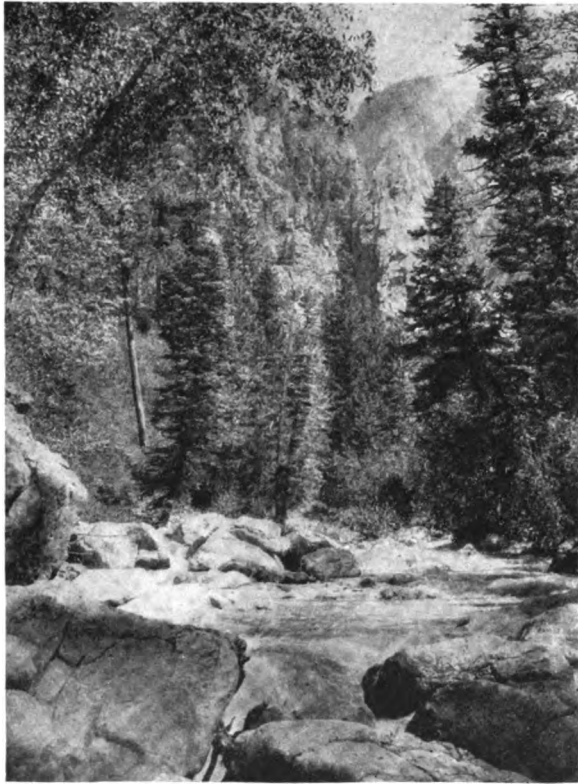


FIG. 44.—Along the Brazos, looking toward the Brazos Canyon. Photograph by Standley.

and then over great polished boulders into broad, deep, dark green pools. It is frequented by large numbers of trout, and for fishing is not excelled by any stream in the state, unless it may be the upper Pecos.

The surrounding country is well timbered, at least in the less accessible portions. The region being included in one of the old Spanish grants, it has been impossible to conserve it in one of the national forests, and most of the yellow pine at lower levels has

been removed. In the vicinity of the canyon, however, there is a moderately heavy growth of Douglas spruce, Colorado blue spruce, white fir, white pine, and yellow pine. Animal life is abundant, especially deer, wild turkeys, grouse, ducks, and beaver. Bears are

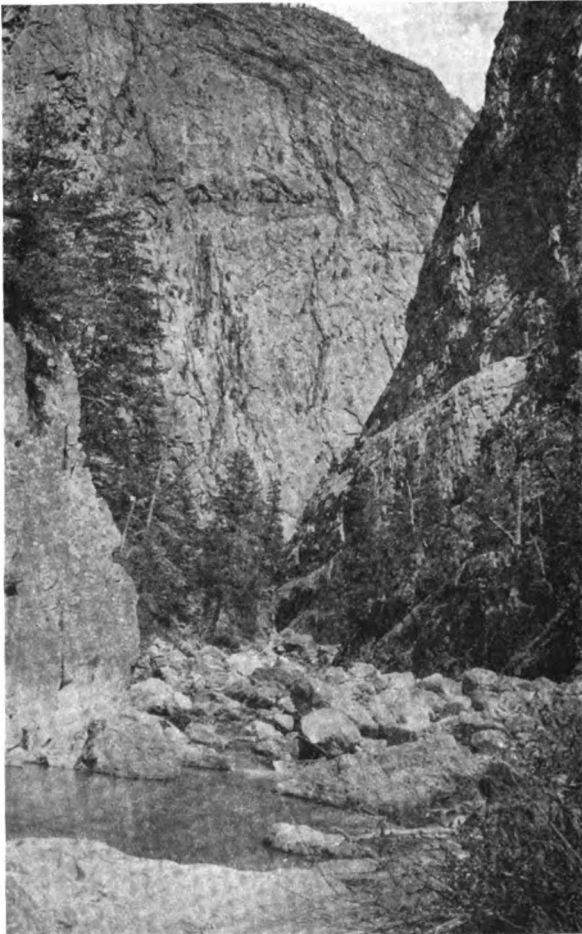


FIG. 45.—Inside Brazos Canyon. The trees are chiefly spruce and fir. Photograph by Standley.

said to be common, but in the autumn they were still feeding at the higher levels and no signs of any were seen.

About 800 specimens of plants were collected, special attention being given to the cryptogams, of which practically nothing is known in New Mexico. Several species of rusts were collected

which are new to the State. The lichens have been named by Mr. G. K. Merrill. Nearly all of them are additions to the known flora of New Mexico, and two of them are undescribed species. The

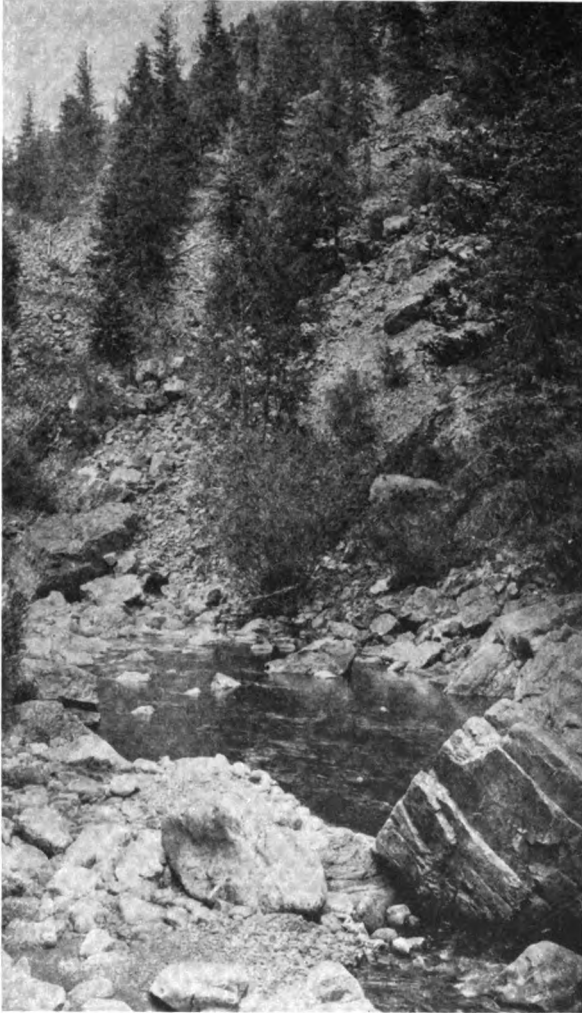


FIG. 46.—Rock slide along the Rio Brazos. Photograph by Standley.

ferns of the Brazos Canyon region are particularly interesting. Twelve species were collected, three of which were not known before from the State. The season was too far advanced to find the flower-

ing plants in the best condition—snow fell on the surrounding mountains the middle of September, just before camp was broken; but a considerable collection was obtained, nevertheless. Although only a part of the phanerogams have been determined, it is found that several species have been added to the known flora of New Mexico. Chief among the additions was a family new to the State, the Sparganiaceae. Several of the plants apparently represent species new to science, descriptions of which will be published later.

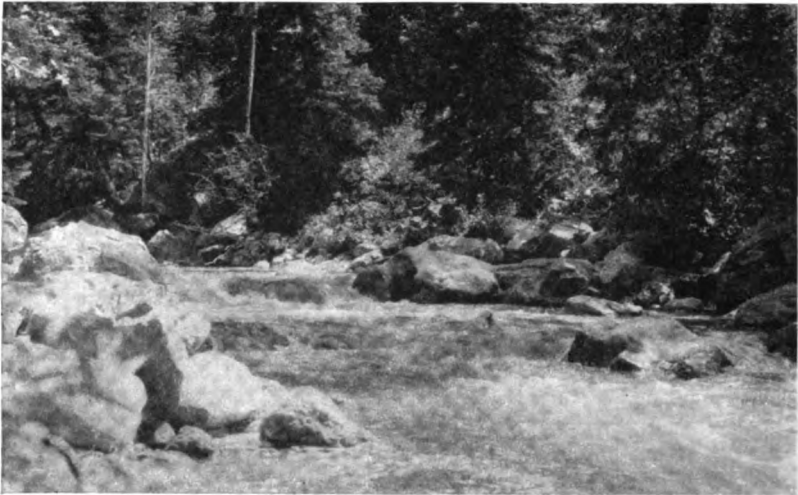


FIG. 47.—Along the Rio Brazos below the canyon. Photograph by Standley.

#### COLLECTING FOSSILS ON CHESAPEAKE BAY

During 1914, several trips were made by Mr. William Palmer to the Chesapeake Miocene on Chesapeake Bay and some very important material was collected. Many years ago four very peculiar caudal vertebræ were described by Prof. Cope as *Cetophis heteroclitus* and these have ever since remained unique. About a dozen vertebræ of this animal were collected during the year by Mr. Palmer, and while the material is insufficient to reconstruct a skeleton, it surely indicates that a snake-like mammal of perhaps 10 feet in length and unlike anything known to-day, inhabited the Miocene sea. The skull is not known.

Material representing Zeuglodont and Squalodont mammals was also collected, indicating that representatives of those groups lived

through the greater part of the existence of the Miocene sea. One specimen is a very perfect skull evidently unlike anything heretofore known from North America. Unfortunately it contained no teeth, but teeth presumably belonging to the species were also collected. Many other vertebræ were found representing known species as well as others apparently new.

#### ANTHROPOLOGICAL INVESTIGATIONS IN GUATEMALA

Early in January, 1914, arrangements were made whereby Mr. Neil M. Judd of the National Museum was enabled to accept an

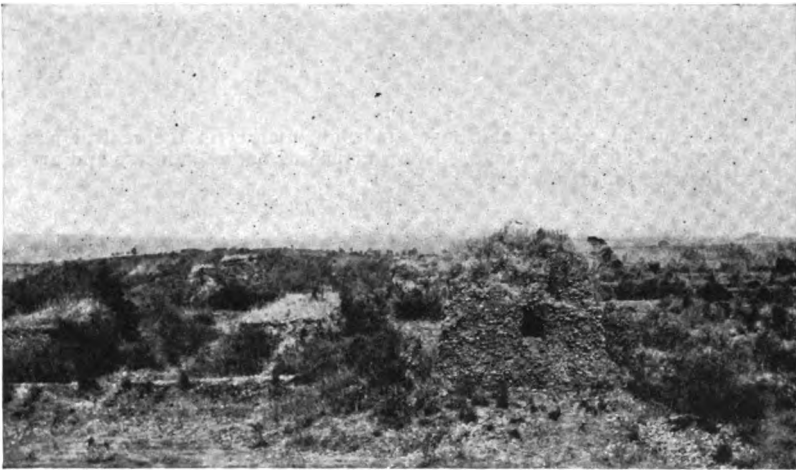


FIG. 48.—A view among the ruins of Utatlan, the last capital of the Quiché empire.

invitation to participate in the third season's archeological investigations at Quirigua, Guatemala, conducted under the direction of Dr. Edgar L. Hewett by the School of American Archæology. Accounts of the earlier investigations have been published by the Archæological Institute of America.<sup>1</sup>

Plans for the expedition of 1914 included a continuation of former excavations upon the prehistoric temples and pyramids surrounding the so-called "Temple Court," the religious center of the sacred city of Quirigua, and the reproduction, in plaster, of several of the huge stone monuments which have made these ruins world-famous. Mr.

<sup>1</sup> Bulletins: Vol. 2, pp. 117-134 (1911), and Vol. 3, pp. 163-171 (1912).



FIG. 49.—Quiché Indians at Sunday morning market in the central plaza, San Tomas de Chichicastenango. Every article of native industry and art is offered for sale on market day.



FIG. 50.—A nearer view of a Quiché fire-altar near San Tomas de Chichicastenango. A horizontal stone bearing the figure of a human being and several lesser carvings stand at the back of the fire pit; rows of the young tips of spruce bows are spread in front.



FIG. 51.—Quiché Indians at fire worship, San Tomas de Chichicastenango. The worshipper stands or squats in front of the fire and mutters his prayers into the rising smoke of his burning copal cakes.



FIG. 52.—1914 excavations on the temple at the north side of the Temple Court, Quirigua, Guatemala.



FIG. 53.—Building the plaster forms around one of the Quirigua monuments. By means of these forms glue molds of the carvings were secured and, from the glue molds, plaster duplicates of the originals were constructed.



Judd was directed to superintend this latter phase of the expedition's activities, and, with the aid of a small corps of able assistants, completed casts from six of the colossal stelæ before the brief "dry season" came to an end. The task of reproduction was greatly facilitated by the use of glue or gelatine, a medium never before employed in the torrid zone. With this material, negative impressions of the carvings and inscriptions were obtained from the monuments; from these impressions, plaster duplicates of the originals were readily constructed. The results far surpassed those which had previously been secured with other processes. The 1914



FIG. 54.—Plaster cast of a "Death's Head" from one of the Quirigua stelæ.

reports of the School of American Archæology consider, in detail, the results of its Guatemala expedition.

At the conclusion of the Quirigua work, Mr. Judd journeyed to Guatemala City and from there by Indian foot paths to the mountain valleys that lie between the capital city and the Mexican border. His object in making this trip was to gain, in the few days at his disposal, a hasty view of present anthropological possibilities among the several Indian tribes who inhabit the region. Although each village has its distinctive ethnological features, but little remains, in the remnants of the Quiché, Cachiquel, and Tzutuhil tribes, to indicate the strength and magnificence of the Quiché empire which Pedro de Alvarado destroyed in 1523, at the beginning of his conquest of Guatemala.

Among other important Indian communities, Mr. Judd visited Totonicipan and Quezaltenango (Xelahun), former Quiché strongholds which have since become, respectively, a modernized Indian town and Guatemala's second city. One day was spent at Lake Atitlan, that beautiful body of water which played such an important part in the pre-Columbian history of the native peoples who knew its shores. Overlooking the blue lake and well-guarded from strangers, are several small villages, their gardens terracing the volcano slopes to a point beyond the drifting clouds. San Tomas de Chichicastenango, with its 16,000 Quiché Indians, and Santa Cruz del Quiché were also visited. At the former pueblo, photographs were taken of a Quiché fire-altar, with Indians at worship. Other fire-altars were noticed before the doors of the two Catholic churches whose white walls tower above the Indian houses.

Near Santa Cruz del Quiché lie the crumbling ruins of Utatlan, the last capital of the Quiché kingdom and the largest and most important of the old cities. Every block of dressed stone has been removed from the old walls and employed in the construction of the modern village—acres of massed cobblestones, plaster-paved courts, and fortifications are all that remain of Utatlan's ancient splendor. At the modern town of Santa Cruz there was an opportunity of witnessing a native play in which was depicted the reception of the Conquerors by the emperor, Nima-Quiché, and the subsequent faithlessness of the Spaniards.

Although the natives of these interior valleys have always been considered treacherous, Mr. Judd experienced few difficulties and his hurried journey seems to indicate that extended anthropological investigations in this region will be as easy as they are desirable.

#### ANTHROPOLOGICAL RESEARCHES IN AFRICA AND SIBERIA.

In connection with the work of the division of physical anthropology in the National Museum, two expeditions were sent out during the year 1914, under the joint auspices of the Smithsonian Institution and the Panama-California Exposition.

One of the two expeditions was in charge of Dr. V. Schück, anthropologist of Prague, Bohemia, and its objects were: 1, to study the negro child in its native environment, and thereby create a basis of comparison for the study of the negro child in our country; 2, to visit the South African Bushmen for the purpose of obtaining measurements, photographs, and facial casts of the same; and, 3, to visit British East Africa in search of the Pygmies. The tribe chosen

for the child study were the Zulu of Natal and Zululand, and over one thousand children and adolescents of all ages—ages which could be definitely determined—were examined. These data are expected to contribute some very important results to anthropology. The Bushmen were reached in the Kalahari Desert and, besides other results, 20 first-class facial casts were obtained of the people, which have since then been installed among the anthropological exhibits at San Diego. As to British East Africa, the work soon after a successful beginning was interrupted by the war; Dr. Schück was arrested and obliged to leave.

The second expedition of 1914 was in charge of Dr. St. Poniatowski, head of the Ethnological Laboratory at Warsaw. The object of this expedition was to visit a number of the remnants of native tribes in Eastern Siberia, among which are found physical types which so closely resemble the American Indian. The expedition reached two such tribes, and secured valuable data, photographs, etc., when it was also interrupted by the war.

#### PREPARATION OF EXHIBITS ILLUSTRATING THE NATURAL HISTORY OF MAN

Some of the results of exploration and field work by the Institution among various races of mankind are shown in connection with the anthropological exhibits of the Panama-California Exposition at San Diego. These exhibits were in preparation for over three years. They are original and much more comprehensive than any previous exhibits in this line, either here or abroad.

The exhibits fill five large connecting rooms, which occupy the building of the Science of Man at the Exposition. Four of these rooms are devoted to the natural history of man, while the fifth is fitted up as a modern anthropological laboratory, library, and lecture-room. Of the four rooms of exhibits proper, the first is devoted to man's phylogeny, or evolution; the second, to his ontogeny, or life cycle at the present time; the third, to his variation (sexual, individual, racial); and the fourth to his pathology and death.

The exhibits in room 1, on human evolution, consist of: (a) a large series of accurate, first-class casts of all the more important skeletal remains of authentic antiquity; (b) photographic enlargements and water color sketches showing the localities where the specimens were discovered; (c) charts showing the relation of the archeological position of the various finds, and their relation to the extinct fauna and to archeological epochs; (d) a series of sketches by various scientific men showing their conception of the early man,

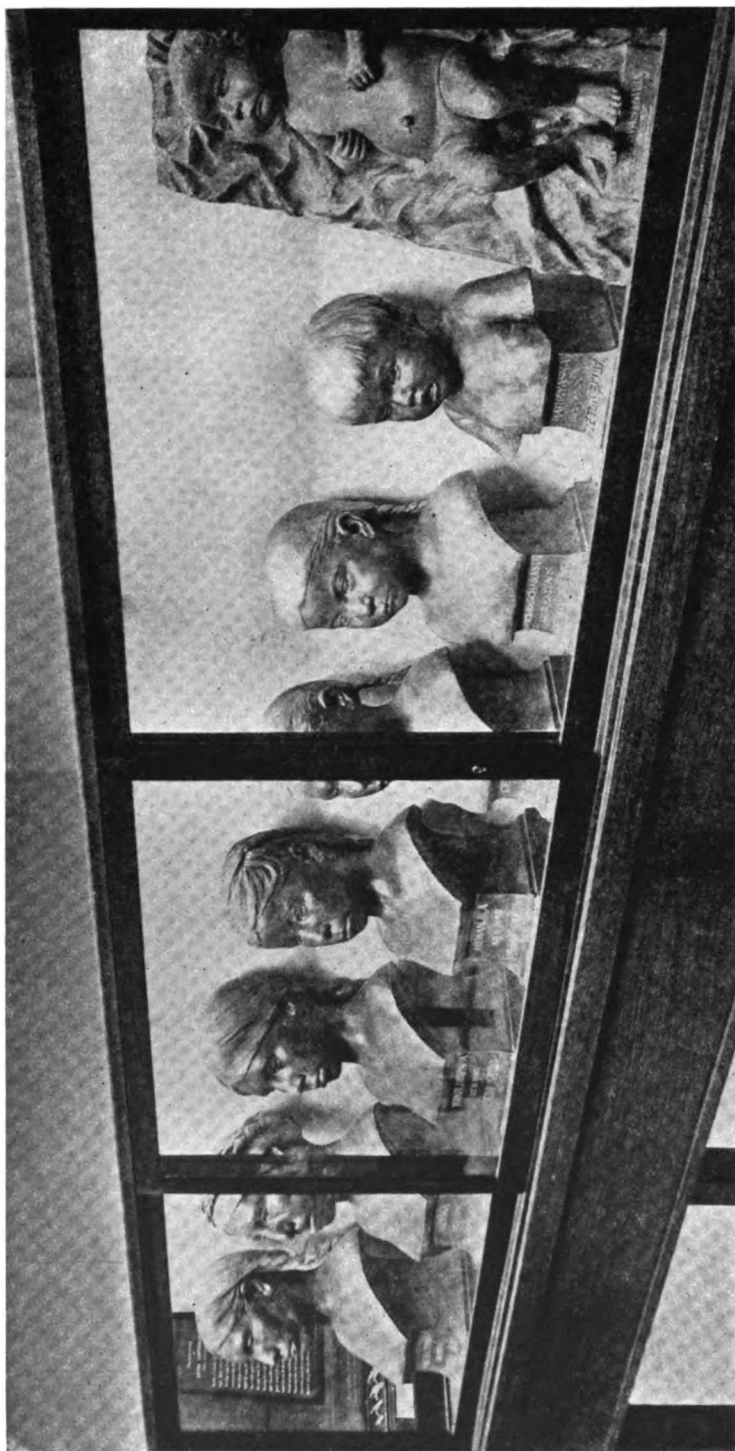
with several illustrations of drawings, statuettes, and bas-reliefs, showing early man as drawn or sculptured by the ancient man himself; and (e) a remarkable series of ten large busts, prepared by the eminent Belgian sculptor, M. Mascré, under the direction of Prof. Rutot, representing early man at different periods of his physical advancement.

The main part of the exhibits in room No. 2, devoted to man's development at the present time, from the ovum onward, are three



FIG. 55.—Five of the Mascré-Rutot busts in the anthropological exhibits at San Diego.

series of true-to-nature busts, showing by definite age-stages, from birth onward and in both sexes, the three principal races of this country, namely, the "thoroughbred" white American (for at least three generations in this continent on each parental side), the Indian, and the full-blood American negro. These series, which required two and one-half years of strenuous preparation, form a unique exhibit, for nothing of similar nature has ever been attempted in this or any other country. Each set consists of 30 busts, 15 males and 15 females, and proceeds from infants at or within a few days after birth, to the oldest persons that could be found. The oldest negro woman is 114. After the new born, the stages are 9 months, 3 years,



• FIG. 56.—A part of the Indian female series at the San Diego anthropological exhibits showing development.

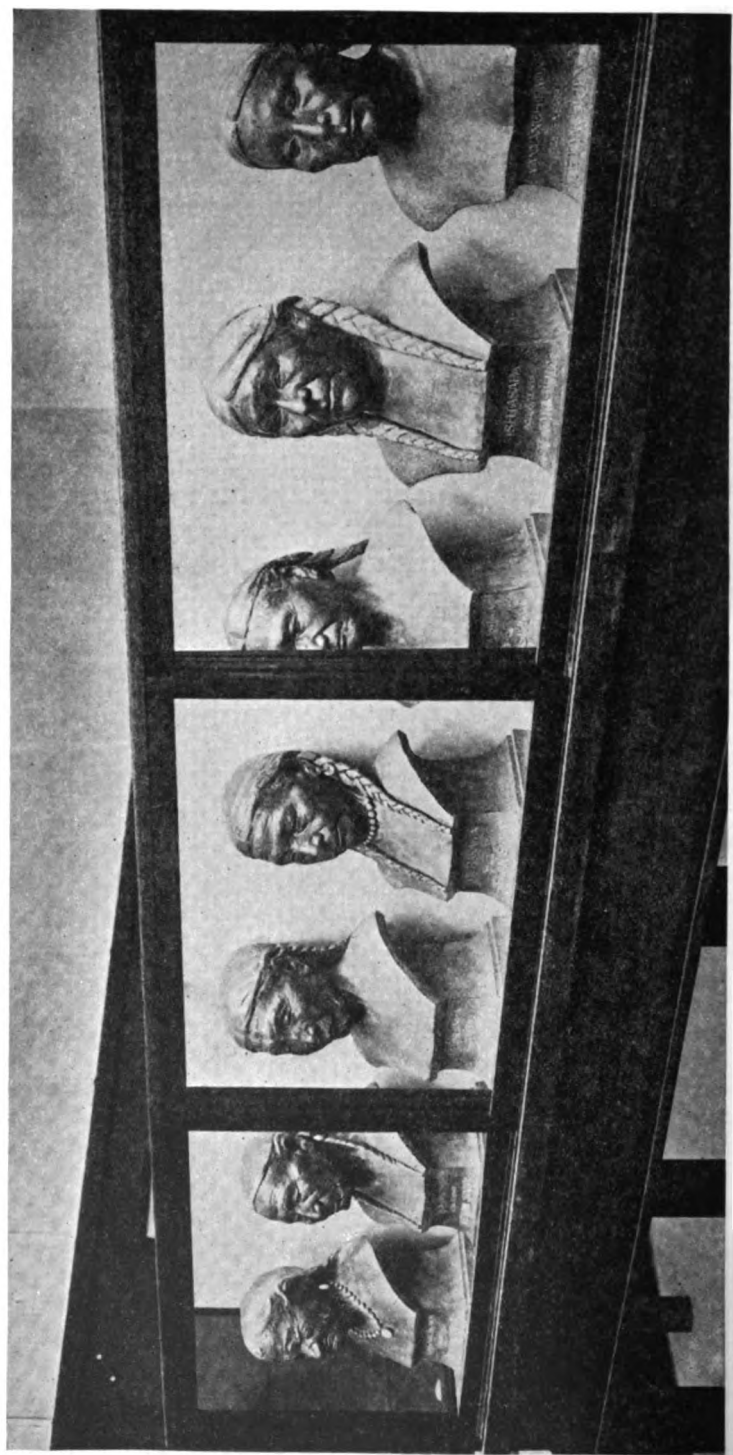


FIG. 57.—The second part of the Indian female series, showing advance with age among adults.

6, 10, 15, 20, 28, 35, 45, 55, 65 and 75 years. The utmost care was exercised in ascertaining the age, particularly among the negro and Indian. No choice was made of the subjects beyond that due to the requirements of pedigree, age, and good health. The whites and negroes were obtained, with a few exceptions, in Washington and vicinity, but their places of birth range over a large part of the Eastern, Southern, and Middle States; for the Indian, we chose the Sioux, a large, characteristic, and in a very large measure still pure-blood tribe, and one in which the determination of the ages of the subjects was feasible. Special trips were made to these people, and no pains were spared to get just what was wanted; in the case of the new born, it was actually necessary to wait until they came.

Other exhibits in room 2 show the development, by various stages, of the human brain, the skull, and various other parts of the body. A large series of original specimens show the animal forms most closely related to man at the present time, particularly the anthropoid apes; a series of charts on the walls deal with the phenomena of senility; finally, ten photographic enlargements show living centenarians of various races.

Human variation is shown in room 3 by ten sets of large busts representing ten of the more important races of man; by 200 original transparencies giving racial portraits; by over 100 bronzed facial casts, showing individual variations within some of the more important branches of humanity; and by numerous charts and other exhibits.

In room 4, a series of charts and maps relates to the death rate in various countries; to the principal causes of death in the different parts of the world, and to the distribution of the more common diseases over the earth. Actual pathology is illustrated extensively by pre-historic American material. Many hundreds of original specimens, derived principally from the pre-Columbian cemeteries of Peru, show an extensive range of injuries and diseases, such as have left their marks on the bones. In many instances the injuries are very interesting, both from their extent and the extraordinary powers of recuperation shown in the healing; while among the diseases shown on the bones there are some that find no or but little parallel among the white man or even the Indian of to-day. In addition, this room contains a series of 60 skulls with pre-Columbian operations (trepanation).

The exhibits as a whole are supplemented by a descriptive catalogue and other literature, and by frequent lectures and demonstra-

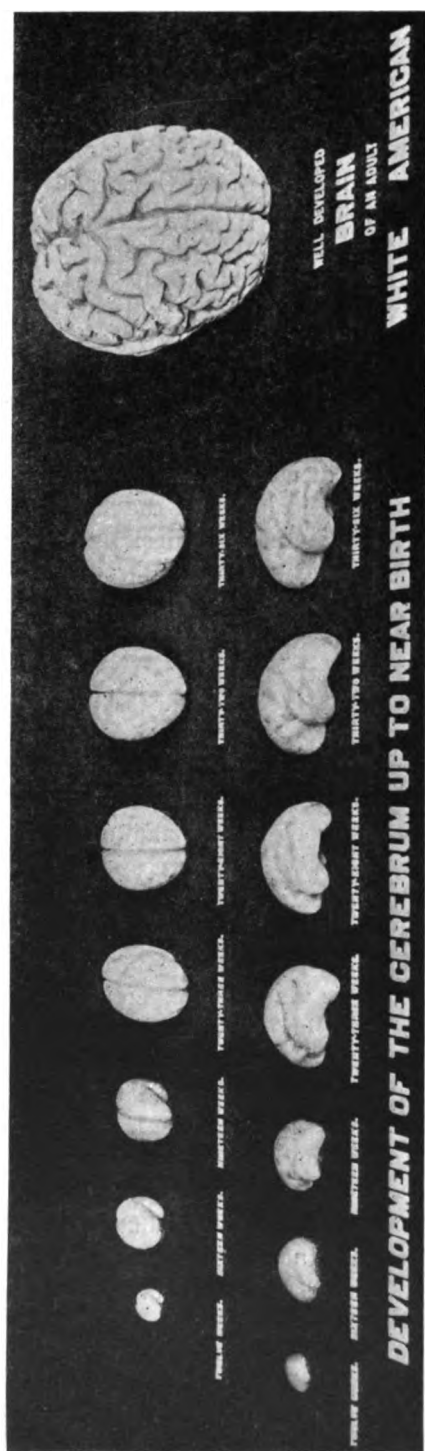


FIG. 58.—Casts in wax and plaster illustrating development of brain.

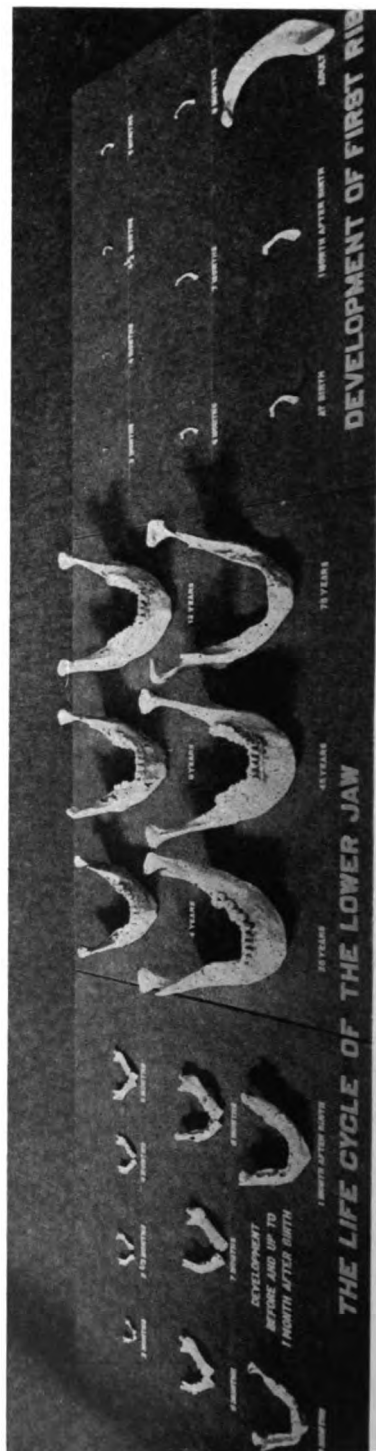


FIG. 59.—Original specimens showing pre-natal as well as later development of lower jaw and the first rib.



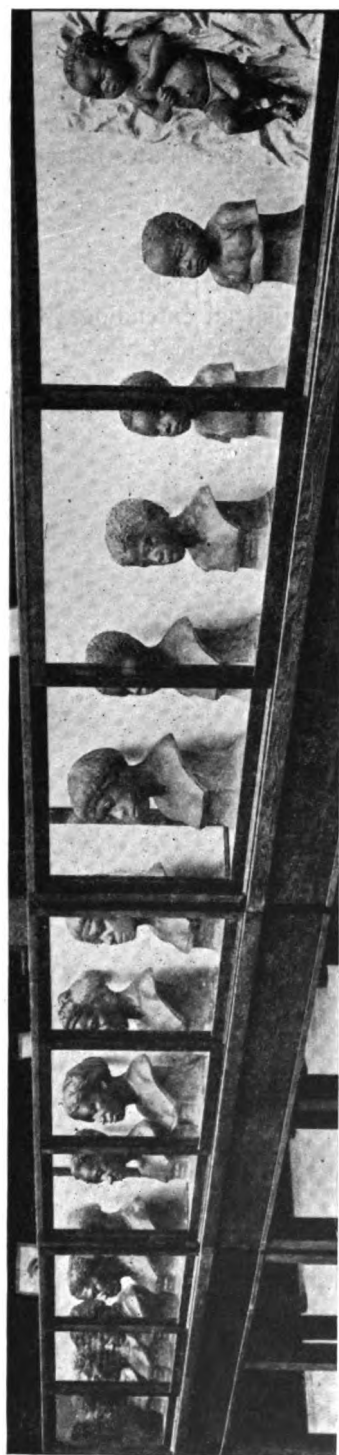


FIG. 60.—The development series of the American female negro, in room 2 of the anthropological exhibits at San Diego.



FIG. 61.—A view of a corner in room 3 of the anthropological exhibits at San Diego, showing the large racial busts, casts, and charts.

tions. They constitute an educational unit of considerable value, have attracted from the beginning the best and most serious attention, and eventually, it is hoped, will become the foundation of a museum in San Diego.

#### PREHISTORIC REMAINS IN NEW MEXICO

Previous to the month of May, 1914, it was pretty generally believed by archeologists that the elevated plateau extending from Deming, New Mexico, to the Mexican border was destitute of any ruins indicating a prehistoric occupation by man. In April of that year Mr. E. D. Osborn wrote to the Bureau of American



FIG. 62.—Ruin near Osborn Ranch. Photograph by J. W. Fewkes.

Ethnology that he had made a considerable collection of pottery and other objects from a village site (fig. 62) not far from his ranch, 12 miles south of that city. From the nature of these objects, especially the decoration on the pottery, photographs of a few of which accompanied his letter, it was apparent not only that the Mimbres Valley was peopled in prehistoric times by a sedentary people, but also that the former inhabitants of this valley had attained a considerable artistic development. Accordingly Dr. J. Walter Fewkes, an ethnologist on the Bureau staff, was sent to Deming to investigate these remains, and to secure, if possible, a typical collection.

He was two months in the field, confining his work more especially to the above mentioned ruin, and to the somewhat larger and more populous village (figs. 63, 64) near Oldtown, 22 miles north of the above mentioned city. He secured by excavation and purchase a

collection of over 200 objects, which are typical and regarded as an important accession to the U. S. National Museum, especially as up to that time objects illustrating the prehistoric development of the



FIG. 63.—Cliff on which Oldtown ruin is situated, overlooking Sink of Mimbres. Photograph by J. W. Fewkes.



FIG. 64.—Oldtown ruin. Photograph by J. W. Fewkes.

Mimbres Valley had been unrepresented in any museum in the world. A preliminary report in which these objects were described and figured was published by the Smithsonian Institution near the close of the year.<sup>1</sup>

<sup>1</sup> Smithsonian Misc. Coll., Vol. 63, No. 10 (Publ. 2316), 1914.

The majority of these specimens are mortuary food bowls, the most significant of which were decorated on their interior with painted figures representing animals known to the ancient inhabit-



FIG. 65.—*a*, Two birds, bowl from Pictured Rocks 4 miles north of Oldtown ruin. Heye Museum. *b*, Two birds, bowl from Pictured Rocks, 4 miles north of Oldtown ruin. Heye Museum.



FIG. 66.—Mortuary food bowls. Photographs by E. D. Osborn. *a*, Four grasshoppers, bowl from Pictured Rocks, 4 miles north of Oldtown ruin. Heye Museum. *b*, Frog, bowl from ruin at Pictured Rocks, 4 miles north of Oldtown. Heye Museum.

ants of the valley, and pictures of warriors or priests engaged in secular or religious observances. Some of the bowls are decorated with characteristic geometrical designs so different from any others yet found in the Southwest that it is believed that they indicate an

undescribed prehistoric culture area in the valley of the Mimbres. The symbolic and other figures show that this culture has affinities, on the one side, with ruins in Chihuahua, and on the other with the Pueblos in northern New Mexico. Some of the fragments of Mimbres pottery are identical with Casas Grandes ware.



FIG. 67.—Geometrical design. U. S. National Museum.

The elevated plateau in which the Mimbres lies is commonly known as the Sierra Madre plateau, which was a trail of migration for interchange of prehistoric cultures of Mexico and the Pueblo region. This plateau extends from the headwaters of the Gila far down into Chihuahua, including the valley of the Casas Grandes River, in which are situated the largest and best preserved ruins of northern Mexico. Between these two extremities may be traced a chain of ruins broken at a few points, indicating prehistoric connections between Mexican and Pueblo culture.



FIG. 68.—Geometrical design. U. S. National Museum.

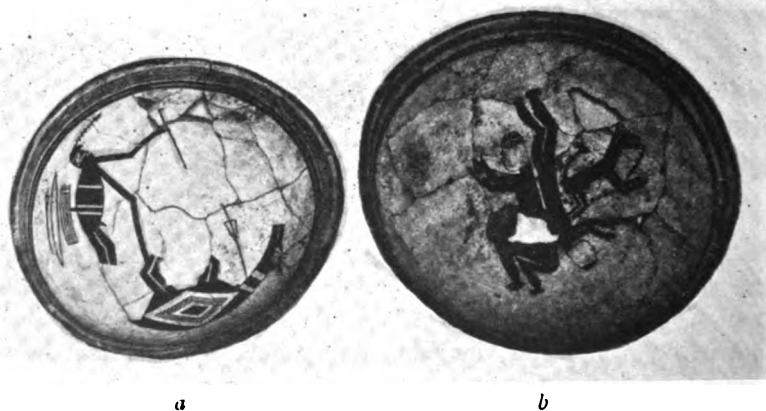


FIG. 69.—Mortuary food bowls. Photographs by E. D. Osborn. *a*, Hunter with throwing-stick, antelope wounded in neck, Oldtown ruin. Heye Museum. *b*, Man carrying a dead man on his back, accompanied by animal. Heye Museum.

It was found that the ancient people of the Mimbres disposed of their dead by inhumation, or earth burial, under the floors of their rooms, and that almost invariably they covered the head or face with a mortuary bowl. This bowl was artificially punctured, or "killed," before it was deposited with the dead, and in many instances the necklaces, bracelets, and other ornaments of the deceased were left on the body.



FIG. 70.—Geometrical design. U. S. National Museum.

Many of the dead were buried in a sitting posture or in the well-known contracted position; the bodies of some were extended at length or placed on one side. Evidences of cremation were not noticed, but charcoal, ashes of burnt timber, and charred corn were repeatedly found in the course of excavating. Several types of stone implements, a few of which are unique, were brought to light by the explorations made by Doctor Fewkes in the ruins of Mimbres Valley. Among the latter may be mentioned a form of rubbing stone, flat on one side but round on the opposite, in the convex surface

of which are cut grooves for the four fingers and thumb of the right hand. A large "holed stone" in the shape of a barrel, found near Oldtown, is a unique form (fig. 74) from the Southwest. One end of this is covered with shallow pits similar to those found on slabs of rocks from other ruins. The use of this stone is unknown, but, like similar holed stones from Mexico, it may have served in the ball game called *pelota*.



FIG. 71.—Geometrical design. U. S. National Museum.

A number of facts were observed in the course of these studies suggesting the probable causes of the abandonment of the pre-historic settlements south of Deming, where the majority of specimens were found. Until a few years ago, the Antelope Valley, except in its northern part or that occupied by the Mimbres, was a desert, capable of supplying water sufficient for stock but hardly adequate to meet the needs of any considerable human population. Notwithstanding this inadequacy of the water supply there is evi-



dence of the existence of several populous villages in what is now an arid desert. Evidently the region formerly had more water than at present, but the reason for its increased aridity and consequent abandonment by the prehistoric villagers was not due to a modification in climate, but to a change in the bed of the Mimbres River, which, there are reasons to believe, has occurred since the advent of man in that valley. The former course of the river past the now



FIG. 72.—Geometrical design. U. S. National Museum.

deserted villages can be easily traced, but by some shifting of the soil in its bed the river now flows to the east of the Florida Mountains. This change in direction deprived the former inhabitants of villages situated on the west side of the mountains of their supply of water, and caused them to abandon their homes.

The construction of the prehistoric buildings, as shown by an examination of the photographs of village sites (f.g.s. 62, 63, 64), indicates that the ancient ruins in the Mimbres region had little resemblance to those of the pueblos in northern New Mexico, but

more closely resembled the fragile-walled dwellings of the Pima and Papago. The walls of the habitations were made of upright logs, chinked and plastered with clay or a natural cement (*caliche*), the base being protected by rows of stones. These walls have fallen, but the stumps of the logs, generally charred, and the rows of stones still remain, while a few feet below the surface the floor is generally

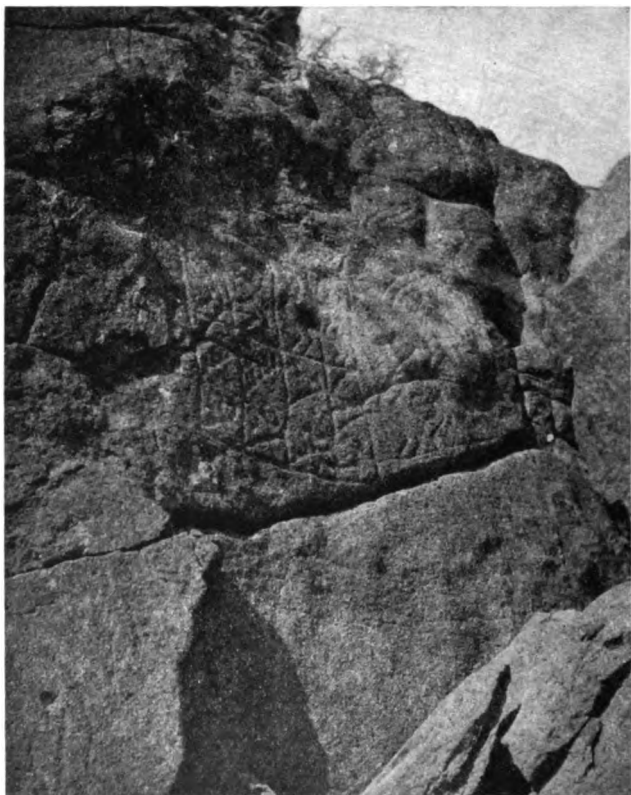


FIG. 73.—Pictographs at Pictured Rocks near Brockman's Mill.  
Photograph by J. W. Fewkes.

well preserved. The roof was flat and held up by one or more vertical logs in the middle of the room. The inner walls of the room were smoothly polished and apparently sometimes painted. The different families composing the population of each village were not apparently crowded into terraced communal dwellings several stories high, but lived in rancherias composed of several one-storied isolated houses.

No evidences were found in the Mimbres Valley of the former presence of walled inclosures or compounds so pronounced at Casa Grande, or of massive buildings found at Casas Grandes. Sacred rooms, or kivas, could not be distinguished from secular rooms, although clusters of depressions resembling subterranean rooms were especially abundant on the terraces along the river banks.



FIG. 74.—Pitted-holed stone, base of Oldtown Cliff. Photograph by J. W. Fewkes.

These rooms undoubtedly belonged to a very ancient type, of which the subterranean sacred room, or kiva, of the pueblo is a survival.

It is believed that the character of the prehistoric culture in the valley of the Mimbres, brought to light by these studies, is more ancient than the true pueblo of northern New Mexico, and closely related to that existing in northern Mexico in prehistoric times.

Several hot springs were examined in the upper courses of the Mimbres which were evidently once used by the natives for sacred

purposes, bones and teeth of extinct animals and stone artifacts, regarded as sacrificial offerings, having been obtained from them.

The accompanying views show the general character of designs on pottery from the Mimbres region, and sites of the ancient villages from which it was obtained.



FIG. 75.—Cherokee ball play: the struggle for the ball.

#### FURTHER STUDY OF THE CHEROKEE SACRED FORMULAS

On June 22, Mr. James Mooney proceeded to the East Cherokee reservation in Swain and Jackson counties, western North Carolina, returning to Washington September 15. Headquarters were made with the most conservative element of the tribe, in the heart of the mountains, some 12 miles above the agency, and the time was devoted chiefly to further study and elaboration of the Cherokee Sacred Formulas previously collected. Opportunity occurred also for witnessing the ceremonial Ball Play, and by special permission of some

of the Indian priests Mr. Mooney was able to be present for the second time at the family ceremony of invoking the blessing upon the new corn and on those about to partake of it for the first time. This ceremony, probably never witnessed by any other white man, is still strictly observed in private at their homes by most of the full-blood families before tasting the new corn of the season, the priests who conduct the rite going, while yet fasting, from house to house through the settlement for that purpose. The so-called Green Corn Dance, the great tribal celebration of thanksgiving for the new corn, was last performed in 1887, on which occasion Mr. Mooney was also present. The East Cherokee, numbering now about 1,600, constitute that portion of the tribe which remained in the old home territory when the main body of the nation was removed to the West.

#### THE SUN AND THE ICE PEOPLE AMONG THE TEWA INDIANS OF NEW MEXICO

One of the most interesting ceremonies observed by Mrs. Matilda Coxe Stevenson during her studies among the Tewa is associated with the coming of spring or the revival of the Earth Mother from her dormant state through the winter. The Tewa are a poetic people, but they never allow their love of the beautiful to interfere with their constant efforts to sustain life. Almost every breath is a prayer, in one form or another, for food. "May we be blessed with food, more food!"—this great thought is paramount among these people who have lived in an arid country from time immemorial. Having no outside resources, everything, life itself, depends upon their own exertions and their influence with their gods. In order to gain this influence they must have priests who are capable of communing directly with the gods. "Heart speaks to heart," they say. The earth must not be wet with summer rains all the time, nor must it be perpetually covered with ice and snow: conditions must be equalized. To accomplish these desired results in past ages the Tewa were divided into the Sun and the Ice people. Each body had its rain priest as it has at the present time, the priest of the Sun people taking precedence over the priest of the Ice people. The special duty of the priest of the Sun people is to observe the rising and setting of the sun, and to bring summer rains and new creations. The priest of the Ice people observes the rising and the setting of the moon, and the moon aids him in keeping the calendars; he brings the cold rains of winter, and the snows and ice to retard plant life. The invocation says in reference to the earth: "Let our Mother sleep; let her rest so covered in ice and snow that she will sleep well

to awake with the coming of spring in all her greatness." While it is the duty of the priest of the Sun people to invoke the Sun Father to bring rains, there is a change in administration from



FIG. 76.—Juan Rey Martinez, ex-Governor and one of the most distinguished theurgists of San Ildefonso.

October 15 to February 18, when the priest of the Ice people assumes precedence over the priest of the Sun people, and he observes the rising and setting sun. He appeals to the Sun Father so to influence

Nukó<sup>a</sup>se, the "black stone man of the north," and Tsä<sup>a</sup> okí Kivi, the "white fog woman of the east," to send their breath to make cold the waters of the rain makers and convert them into snow and ice. Summer winds are the breath of the gods.

While the moon is feminine with many Indians, the Tewa believe the moon to be masculine and brother to the sun. In fact, these divine ones, according to Tewa philosophy, are the gods of war, born of a virgin and conceived through the embrace of the rays of the ancient Sun Father while the maiden slept on the banks of the lake Aga'chännê. Pregnant as she was, the maiden tossed in a canoe for many days upon the angry waters during the great flood that covered the earth. Finally the bark landed near the site of Santa Fe, where the maiden gave birth to twin sons. When the divine ones learned of their father they determined to find him. The earth was dark in the day and in the night, but the little fellows were guided by Kosa, star people who emitted bright light from their bodies. The father was found in a lake deep under the earth. The aged Sun Father recognized his children and wept for joy at meeting them. He said to them: "The earth is now dark, but it should have light and warmth. I will make you boys the sun and moon to pass over the earth with the burning shields of crystal." He designated the younger one to be the sun and the elder to be the moon. The divine ones were happy to remain with their Sun Father and to perform the duties assigned to them. The present sun and moon bear the names of their predecessors, Tapsédo, "sun old man," and Po'sedo, "moon old man." They are still elder and younger brother warriors, and are appealed to as such by the elder and younger brother Bow Priests, who are the earthly representatives of these gods. The ancient Sun and Moon remain in their house below, while the divine ones do duty in the world above.

Preparatory ceremonies for the coming of spring begin at sunset of February 9th in San Ildefonso and close at sunrise the morning of the 13th. The first three nights the party disbands at midnight, provided there are no serious interruptions in rehearsing the ancient songs. This must be learned from the director of the Squash fraternity, who knows the ancient prayers and songs by heart. The first three nights the party in the kiva consists of the rain priest of the Sun people, his four male and two female associates, younger brother Bow priest, and the director of the Po'kuni, native Squash fraternity. The Bow Priest is present as guardian of its altar, and the director of the fraternity as the sage of San Ildefonso. The e'he altar is erected by the rain priest of the Sun people. On completion of the

altar the rain priest makes a sand painting on the floor a little to the northeast of the altar. First a circular ground of sand from the river bank is laid; this is outlined with a circle of black earth from the river bed; the entire disk is then covered with fine white earth; a small blue disk is next made in the center of the large one, which is then surrounded by a circle of yellow and one of red. Four crosses representing the Pleiades, are made in black upon the smaller disk. This sand painting is made in honor of the ancient Sun and Moon and remains until the close of the fourth night, when the Priests of the Bow gather the sand into a cloth and deposit it in the Rio Grande to be carried to the house of the ancient Sun and Moon.

On the fourth and last night the party in the kiva is joined by the rain priest of the Ice people, his four male and two female associates, and the elder brother Bow Priest. The priest of the Ice people sits at the northern side of the altar, the priest of the Sun people at the southern side, while the director of the Po'kuni fraternity takes his place at the north. The associates of the rain priest of the Sun people sit back of him and south of the altar, and the associates of the priest of the Ice people sit back of him and north of the altar. The two rain priests discuss the change of the seasons, the rain priest of the Sun people urging that in case the rain priest of the Ice people is not sure of his functions, he consult the priest of the Ice people of Tesuque. The rain priest of the Sun people and the director of the Po'kuni, or native Squash fraternity, make no claim to understanding the songs and prayers for ice and snow, but the sage has a perfectly clear knowledge of all ceremonies associated with the Sun people, and there is no time in the year when so important a ceremony for the good of all the people is performed as the one here described. Unless the long and most ancient rites to the "old" Sun are observed at this time, there can be no certainty of the fructification of the earth. The hearts of all the people are filled with a great desire so to please the ancient Sun Father that he will use his power to have the rain-makers send the spring rains and cause the Earth Mother to send forth her being in all its beauty.

The great ceremony is performed on the night of the 17th of February. This is no ordinary occasion. All the fraternities gather in the kiva presided over by the priest of the Sun people. Every man, woman, and child presents offerings to the ancient Sun Father, which are deposited in a heap before the altar. Each member of the order of Mystery Medicine carries the wowayí (a perfect ear of corn decorated with macaw and other plumes), and places it before



the altar. The fraternities of the Sun people take seats south of the altar, the women sitting together back of the male members. The fraternities of the Ice people sit north of the altar, the women grouping slightly apart from the men. After all the rehearsals of the priest of the Sun people and the sage of the kiva the people feel pretty sure that their songs and prayers will be recognized and received by the ancient Sun Father. All the men present sing to the accompaniment of the rattle and pottery drum. They are perhaps more profoundly interested in this ceremony than in any other, for this ritual enters into the very heart of their lives. This great ancient Sun God sits in state in his house in the lake, and it is only once a year that the people as a body invoke him. The larger the family the greater the offerings, which consist of all food that can be obtained by the Indians of to-day, and calico, cotton cloth, and a variety of other things. These offerings are made to Tansédo with prayers that he will see that the people may be able to secure the desired objects. All parties dance, except the priest of the Sun people and the director of the squash fraternity. These two must listen attentively that no mistake may be made in the song. The priest of the Ice people and his associates are present, having the same position they occupied at the previous meeting. He and his associates join in the dance for the new creation. The men are nude except for the breech-cloth, and their bodies are daubed in white. The women wear the native black woven dress and red belt, but arms, neck, and legs are bare. Each man carries a rattle in the right hand and a sprig of spruce in the left. The women carry an eagle-wing plume in each hand. The spruce signifies the male element, rain. The eagle plumes signify the same, for eagles live among the clouds. All night the dance and song continue, invoking the ancient one. Referring to the great heap of offerings, they sing: "We give these offerings to you; you are great, the ancient one, you who have lived always, that you will be happy and contented; that you will see that all the world receives much water that all crops may develop for good. We pray that you will talk to the rain-makers, urge them to go out and play their games and be happy, and to send rains to every quarter of the world, such rains as will uproot trees, wash out canyons, and cover the Earth Mother in water. Let her heart be great in water. And we pray that you will lift the Earth Mother from her sleep, impregnate her with your rays, and make her fruitful to look upon. Bless the whole world with her fruitfulness." These are the invocations to be heard throughout the night, when all present put their whole souls into supplicating the Ancient One for

food to sustain life. The songs continue until the first light of day, when the great heap of offerings are carried to the river and deposited to go to the ancient Sun Father. The sands of the painting are also deposited, wrapped in a cloth, in the river.

These children of nature feel every confidence that the performance of the ritual so sacred to them will bring all that their long prayers have asked for throughout the night.

#### WORK AMONG THE IROQUOIS

Mr. J. N. B. Hewitt left Washington on December 11, 1914, for a short field trip among the Iroquois of Ontario, Canada, and of western New York. His first stop was at Brantford, Ontario, where, with the aid of Mr. William K. Loft, a Mohawk speaker, critical phonetic and grammatic study was made of portions of Mohawk texts relating to the Iroquois League, recorded by Mr. Hewitt in former years. Work was also done in taking down a select list of Mohawk verbs for comparative purposes. His next stop was at Middleport, Ontario, where, with the aid of Mrs. Mary Gibson, the widow of the late Chief John Arthur Gibson, Mr. Hewitt recorded a long Cayuga text relating to the origin and ritual of the Death Feast; a comparative Cayuga list of verbs was also obtained. Here, with the aid of Mr. Hardy Gibson, a Cayuga chief, Mr. Hewitt was able to clear up satisfactorily certain mooted questions concerning the ritual of the League Condoling and Installation Council.

Mr. Hewitt also obtained from Mrs. Emily Carrier a list of 50 Nanticoke words which represent all that were remembered by the informant; this short list is of unique interest, as the Nanticoke dialect of the Algonquian stock has become practically extinct. Mr. Hewitt also made about 70 photographs, chiefly of persons.

#### OSAGE SONGS AND RITUALS

During the year 1914, Mr. Francis La Flesche, ethnologist, secured from Wá-thu-xa-ge, a member of the Tsi-zhu Wa-shta-ge, one of the two peace gentes of the Osage tribe, the rituals and songs of the Wa-xó-be A-wa-tho<sup>a</sup>, which form the first of the seven degrees of the great Osage tribal war rites. It was with much difficulty that Wá-thu-xa-ge was finally persuaded to give this information. He had three reasons for refusing to give information concerning the rites, which are now being fast forgotten, as most of the older members of the tribe have adopted a new religion to which they give nearly all their thought and attention, and the younger members who are being educated care very little, if at all, for these ancient rites.

The first reason given by Wá-thu-xa-ge for refusing to recite the rituals and to sing the songs is, that he feared to make mistakes which would expose him and his family to punishment through super-



FIG. 77.—Wá-thu-xa-ge of the Tsí-zhu Wa-shta-ge, a peacemaking gens.

natural means ; second, that the man who introduced the new religion, above referred to, forbade those who took up the new faith to give any further thought to the ancient rites, which he told them were the inventions of Ts'a-to<sup>n</sup>-ga, the Great Serpent, to lead the people

astray and to prevent them from finding the true path to God; third, he suspected the man who introduced Mr. La Flesche to him, and who also belonged to the Tsí-zhu Wa-shta-ge gens, of seeking to secure a working knowledge of the rituals and songs without going through the required ceremonies and the payment of the usual fees.

The Wa-xó-be A-wa-tho<sup>n</sup> degree of the Tsí-zhu Wa-shta-ge gens, like those of the other gentes, is divided into two great parts. The first part is called the "Seven Songs" and the second part the "Six Songs." The titles of the songs and rituals of the various gentes are generally the same, but the music and the words differ more or less. The number of the songs also varies in the degrees of the various gentes. Wá-thu-xa-ge explained that the number of songs in the war ceremonies of his gens are fewer than those of any of the other gentes because of its position in the tribe as a peace-maker, and that the performing of the war ceremonies of his gens was more a matter of form than for the purpose of encouraging a warlike spirit.

In some of the degrees the songs and rituals of both of the two parts are used, in others only those of the first part, and still in others those of the second part. While the various degrees are used in common, in forms more or less modified, by the various gentes, it is said that the "Seven Songs" belong to the Ho<sup>n</sup>-ga dual division, whose ceremonial place is at the south side of the lodge, and the "Six Songs" belong to the Tsí-zhu dual division, who occupy the north side. There also appears to be a further division of the songs and rituals among the several gentes, thus giving the rites, as a whole, a composite character.

The degree given by Wá-thu-xa-ge, whose portrait is here shown (fig. 77), is composed of six rituals and 65 songs—49 songs for the first part and 16 for the second. There are certain preliminary ceremonies that are performed before conferring a degree which contains all of the rituals and songs, or only the first or second parts. These preliminary ceremonies have also been explained by Wá-thu-xa-ge.

For many years this old man has not had occasion to perform the ceremonies, therefore his memory of them had weakened considerably. In order to refresh his memory, for the purpose of giving this information, he attended an initiation which took place a week or so before he came to Washington, although the new religion which he had adopted discouraged his witnessing, or his taking part in, any of the ancient rites. Wá-thu-xa-ge's wife, who was an honorary member of the No<sup>n</sup>-ho<sup>n</sup>'-zhi<sup>n</sup>-ga order, assisted him materially by prompting him. Wano<sup>n</sup>-she-zhi<sup>n</sup>-ga, whose English name

is Frederick Lookout and who a year ago was the principal chief of the Osage, not only gave assistance with what knowledge he had of the rites, but it was through his influence and urging that the old man consented to give what he remembered of them. Had "Governor" Lookout been less urgent the chances are that the old man would never have given the information and it would probably have been lost at his death.

The words of the rituals and songs of the first part of this degree have been transcribed and type-written, and the music has been transcribed from the dictaphone, but the words of the songs and the music of the second part have yet to be transcribed.

Wá-thu-xa-ge also gave, in fragments, the Ni-ki-e degree of his gens. It was difficult for him to recall all of the songs, rituals and ceremonial forms. Of this degree he gave three rituals and eleven songs. The stanzas of these songs vary in number from one to eleven. Mrs. Lookout said that the Ni-ki-e degree of the Tsi-zhu Wa-shta-ge gens is not half as long as those of the other gentes. She had taken part a number of times in some of the ceremonial forms and thus had gained her knowledge first hand.

Aside from the two degrees of the No<sup>n'</sup>-ho<sup>n'</sup>-zhi<sup>n'</sup>-ga rites, eight songs of the new religion were secured from Wá-thu-xa-ge and "Governor" Lookout, who both take active part in the exercises of this religion.

#### PRESERVATION OF INDIAN MUSIC

Two field trips were made by Miss Frances Densmore during the summer of 1914. The first trip was to the Standing Rock reservation in North Dakota, the purpose of which was to revise certain portions of the manuscript on Sioux music; this was accomplished by reading the manuscript to several old men of the tribe. Additional information was secured concerning the Hunka ceremony and the Spirit-keeping ceremony, as well as on other subjects which had been studied on previous visits to the reservation. Songs were also recorded to complete certain series in the material in preparation for publication.

The second trip was to the Uinta and Ouray reservation in north-eastern Utah. The Indians on this reservation are the northern Ute who formerly lived in northern Colorado and are best known by their comparatively recent expedition into South Dakota, whence they were brought back by United States troops. The nucleus of that expedition was the White River band of Ute, and one of their leaders was Red Cap, chief of the White River band, whose

photograph is shown in figure 78. As the location for her work Miss Densmore selected Whiterocks, a point 15 miles beyond the agency and 80 miles from the nearest railroad. Whiterocks is the

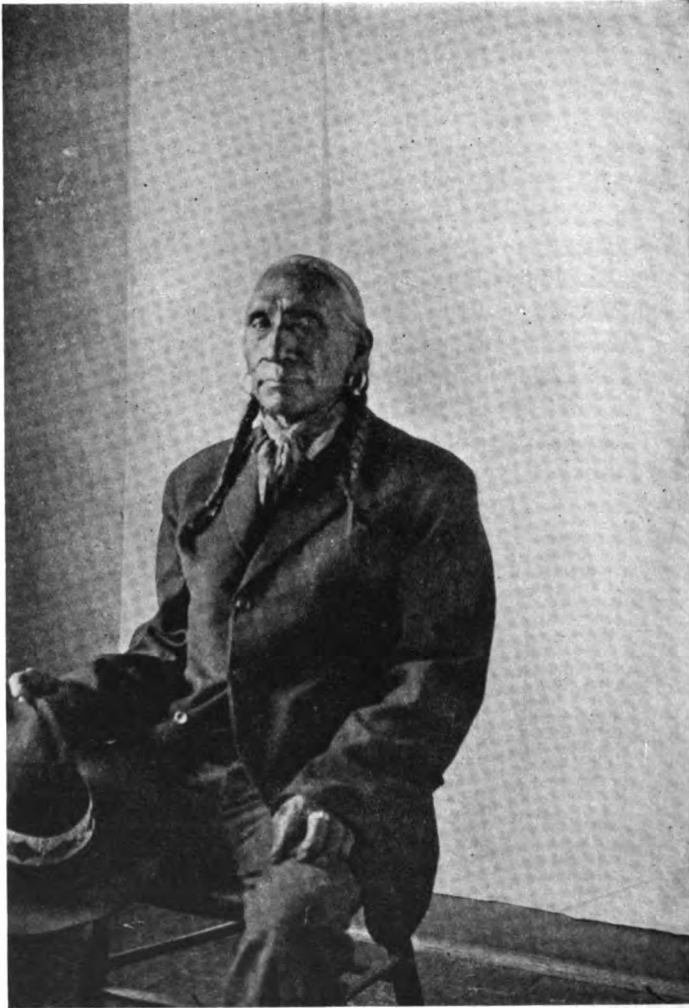


FIG. 78.—Portrait of Red Cap, chief of the White River band of Ute. Photograph by Miss Densmore.

point nearest the camps of the White River Ute, who were the principal subject of investigation.

The difficulty of the work had not been overestimated. The Indians were more conservative than any before encountered. Never having seen a cylinder phonograph, a belief gained some credence

that whoever sang into the instrument would shortly die, hence considerable open opposition developed. Fortunately, this was overcome by the exercise of patience and diplomacy.



FIG. 79.—Sub-chief of the White River band of Ute, commonly known as "Little Jim." Photograph by Miss Densmore.



FIG. 80.—Typical summer abode of the Ute on the Uinta and Ouray reservation. Photograph by Miss Densmore.

After this adjustment of relations with the Ute the work progressed with less difficulty. More than 80 songs were recorded, including songs of the Sun Dance, Bear Dance, and other native dances, as well as very old war songs, and songs used in the treat-

ment of the sick. There were also recorded several folk-stories given by a very aged woman in the manner of a chant. The songs are very diversified and show the people to be unusually musical. Among the Chippewa and the Sioux there were old men who said that when they were young the medicine-men received songs in dreams, but among the Ute this is a custom of the present time. Many "dream songs" were recorded, among them a set of six songs by a young man who said they "were taught him by a little green man who lived in a little stone house far up the mountain." Much interesting information was received concerning this mythical "green man."

The industries of these people also received consideration, and a collection of specimens representative of these industries was purchased. Among these was a bowl-shaped basket, which in old times was placed over an excavation in the ground, the singers sitting around it and accompanying their songs by the rasping together of two sticks, the longer of which was notched. This notched stick rested upon the inverted basket and the shorter was rubbed across it. This music is used only in the Bear Dance, which appears to be peculiar to these people and is still held every spring. A Sun Dance was performed last June in direct violation of orders from the Government. The Sun Dance ground was visited. Neither the Bear Dance nor the Sun Dance was held during Miss Densmore's visit, but she attended a Turkey Dance, which is the mid-summer dance of the tribe and is held about once a month.

In connection with the industries of the Ute Miss Densmore secured a fire-making apparatus in which a blunt stick and sharp sand were used, instead of the usual pointed stick. The "hearth" was similar to that in use among many tribes, except that it contained a little reservoir for the sand and a "spillway" through which the sand, heated by the friction of the rotated stick, could run down upon the fragments of bark to be ignited. A unique specimen of woven work was made for Miss Densmore, consisting of a net for fish or rabbits, formed of the outer bark of reeds, a very delicate tissue which required skilful manipulation to make it into a substantial net.

Many visits were made to the camps, figure 80 showing a typical summer abode of these Indians. Their winter homes are log huts with earth floors. At some distance from Whiterocks is the burying-ground of the Ute. The burial places are marked by the bones of horses slain at the death of their owners. An offering of corn had been placed in one of the trees, and from another hung the head of a



dog with the rope still around the neck. Tipi-poles, cooking utensils, children's toys, and clothing were among the articles placed on the graves of their owners.

The work of last summer emphasizes the close connection between the music of the Indians and the beliefs or ceremonies which they hold most sacred, and in this lies one of the advantages in the study of Indian music. If an Indian consents to sing a song he appears willing to give information which might be difficult to secure in any other manner. An instance of this is the narration of personal dreams or visions, and the relation of ceremonial duties by those who have held responsible positions in native ceremonies. The collection of Indian songs for preservation and for analysis is important, but the recording of these songs also opens the way for the securing of interesting and valuable descriptive material.

#### ETHNOLOGICAL RESEARCHES AMONG THE KALAPUYA INDIANS

Dr. Frachtenberg left Washington on July 6, 1914, going directly to Oregon for the purpose of concluding his investigations of the language, mythology, and culture of the Kalapuya Indians which he had commenced during the previous fiscal year. After a short trip to the Siletz and Grande Ronde agencies in northwestern Oregon, made with the object in view of interviewing all available informants, he proceeded to the United States Indian Training School situated at Chemawa, where he was soon joined, first by Grace Wheeler and, later on, by William Hartless. These two Kalapuya Indians were his chief informants, and he worked with them during the months of August, September, October, November, and part of December. This work was brought to a conclusion by a stay at the Grande Ronde agency that lasted from December 13 until December 20; this brief time was spent mainly in collecting material for a comparative study of the Kalapuya dialects. A planned trip to the Yakima reservation for the purpose of interviewing the sole survivor of the Atfalati tribe had to be abandoned, owing chiefly to the lack of funds.

Dr. Frachtenberg's field work proved highly successful. He obtained 30 myths, tales, historical narratives, and ethnographic descriptions, told in the various Kalapuya dialects, an unusually large amount of grammatical notes, sufficient material for a linguistic map of the several Kalapuya dialects, and some data on Kalapuya ethnology.

A glance at this material reveals some very interesting facts. The Kalapuya Indians in former days were the most powerful and numerous family inhabiting the present State of Oregon. They claimed possession of the whole fertile valley of the Willamette River, which extends from the Coast Range on the west to the Cascade Mountains on the east. Their settlements reached as far north as Portland and as far south as the middle course of the Umpqua River. This territory comprises an area of approximately



FIG. 81.—Charles Bradford and wife, Smith River (Athapascan) Indians. Courtesy of Dr. Max F. Clausius, Siletz, Oregon.

12,000 square miles; and its topographic nature, its rich fauna and flora, its streams that abound in all kinds of fish, justify the assumption that it sustained a large number of inhabitants. These Indians were brought into the Grande Ronde agency in 1857, at the close of the Rogue River war. Unfortunately tribal wars and epidemics of smallpox and tuberculosis have decimated the several Kalapuya tribes to such an extent that Dr. Frachtenberg found a mere handful of these natives, and the time is not far off when the Kalapuya Indians, like so many other tribes of the Northwest, will have become an extinct group.



FIG. 82.—Ed Bensell and wife, Makwana-lunne (Athapascan) Indians, dressed for a "Feather Dance."



FIG. 83.—Jennie Rooney, an aged Tula-lunne (Athapascan) woman, ready to participate in the "Feather Dance."

The Kalapuya family embraces a number of tribes, the most important of which are given here as follows: (1) Atfalati, living formerly on the banks of the Tualatin River; (2) Yamhill, claiming as their possessions the banks of the river bearing their name; (3) Lakmayuk, who derived their name from the River Luckiamute; (4) Marys River (Calapooia Proper), whose settlements were situated along the banks of the Calapooia and Marys rivers; (5) Yonkalla, the most southerly Kalapuya tribe; (6) Ahantsayuk, also called Pudding River Indians; and (7) Santiam, who formerly lived on the banks of the Santiam River.

These several tribes spoke varieties of the Kalapuya language that show remarkable lexicographic diversity. Morphological differentiation exists also, but it is chiefly of a phonetic nature. All differences between the various Kalapuya dialects seem to have been caused by a geographic distribution, resulting in three subdivisions, within which idiomatic differentiation is very slight. Thus, the Yamhill and Atfalati dialects form one subdivision; Ahantsayuk, Santiam, Marys River, and Lakmayuk form the second, while Yonkalla belongs to a group of its own.

The Kalapuya language, while showing great phonetic variations (such as the occurrence of a labial spirant *f* and the presence of the trilled *r*), is structurally closely related to the languages of the neighboring tribes, such as the Coos, Siuslaw, Yakonan, Salish, and Athapaskan. It belongs to the same type; that is to say, similar psychologic concepts are expressed by means of identical grammatical processes. The language belongs to the suffixing type. Its mythology differs in no way from the mythologies of the other tribes of western Oregon, being characterized by the absence of a distinct creation myth and by the preponderance of animal tales belonging chiefly to the Coyote cycle. An interesting phase of Kalapuya mythology is the presence of elements of European folk-lore, especially the absorption of French fairy tales that deal with the exploits of the orphan Petit Jean. This feature will be made the subject of a separate paper, which will probably appear in the near future.

The long and continued contact of the Kalapuya Indians with white settlers has resulted in a complete breaking down of their native culture and mode of living. Consequently, the ethnological data that could be obtained by Dr. Frachtenberg were very meager and, in most cases, were given as information obtained through hearsay.

INVESTIGATIONS AMONG THE STOCKBRIDGE, BROTHERTON,  
AND FOX INDIANS

Early in July Dr. Michelson left for the United States Indian School at Carlisle to arrange for future translations of his Fox texts by Horace Poweshiek, as well as to obtain some linguistic notes on Sauk and Fox. He then proceeded to Wisconsin to investigate the Stockbridge Indians. His headquarters were at Keshena. About



FIG. 84.—Fox sacred pack.

a dozen persons were found who could give isolated words in the Stockbridge (Mahican) language, but only one person who could dictate connected texts. About a half dozen of such texts were obtained with difficulty. Knowledge of the language was too far gone to permit unraveling its details, but nevertheless sufficient material was obtained to show conclusively that Stockbridge belongs closely to Natick and Pequot-Mohegan, which are closer to each other than either is to Stockbridge. Stockbridge likewise shows certain affinities with Delaware-Munsee. If more material can be obtained on a future visit, a brief memoir on this language may be expected.



FIG. 85.—Fox sacred pack.

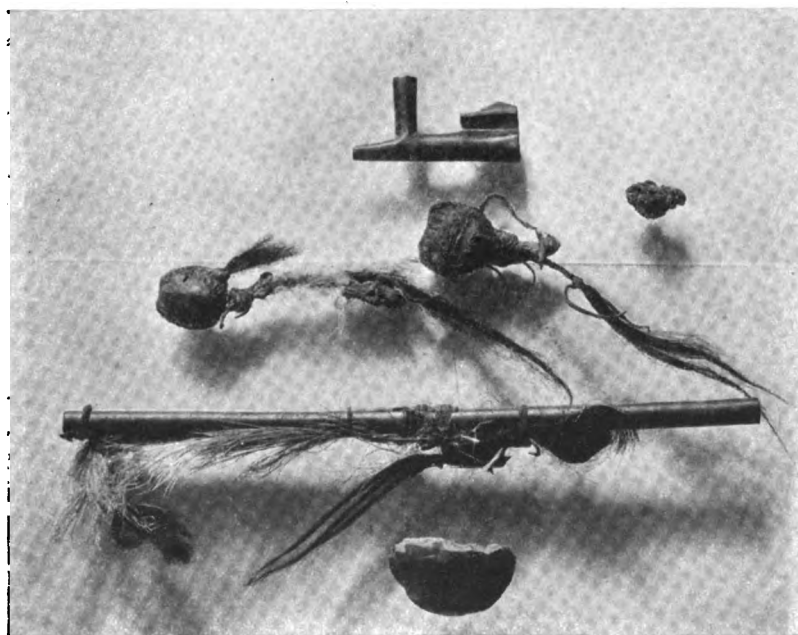


FIG. 86.—Contents of Fox sacred pack.

Some incidental notes on Menominee linguistics and ethnology were obtained.

Among the Stockbridge, near Lake Winnebago, only one person was found who could give even isolated Stockbridge words, and no one who could dictate texts.

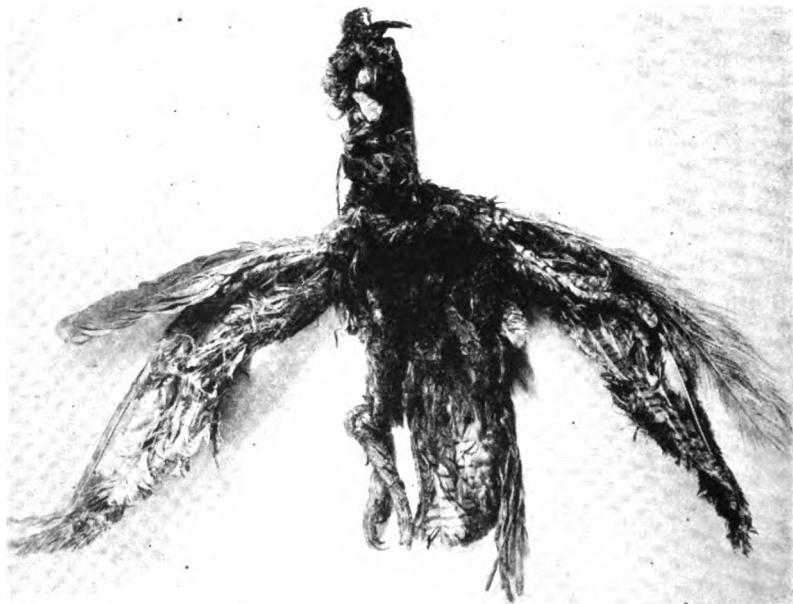


FIG. 87.—Contents of Fox sacred pack.

There are probably no absolutely pure-blood Stockbridge Indians living, though perhaps 50 are nearly so; the remainder show various degrees of mixture with white and negro blood, and some with both; however, in all cases the Indian characteristics predominate.

Dr. Michelson next proceeded to investigate the so-called Brother-ton Indians near Lake Winnebago. Unfortunately not a single



person had knowledge of anything Indian except the tribal history. Here again no full-bloods could be found; practically all showed a large infusion of white blood.



FIG. 88.—Alfred Kiyama, full-blood Fox Indian, age 45. Tama, Iowa.

He next went to continue his work among the Foxes of Iowa. Here particular attention was paid to ritualistic origins; likewise some translations of myths and tales were obtained. Some information was also procured concerning the ancient Midewiwin ceremonies. This information, however, must be checked by the Sauk

of Kansas and Oklahoma, as these ceremonies are now extinct among the Foxes proper.

The accompanying photographs are those of a Fox sacred bundle, with its contents, which is now in Berlin, and of a Fox Indian.

#### STUDIES OF SOLAR RADIATION

*Mount Wilson work.*—The Astrophysical Observatory continued its observations on Mt. Wilson, Cal., for the purpose of measuring the intensity of the sun's radiation, as it is at the surface of the earth,

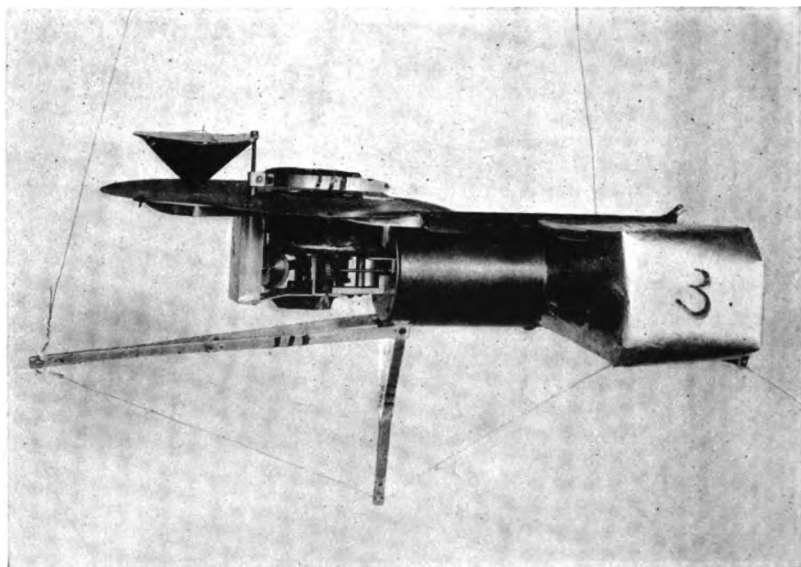


FIG. 89.—Balloon Pyrheliometer.

and the losses which it sustains in passing through the atmosphere, so as to permit the determination of the mean intensity outside the atmosphere, which is called the solar constant of radiation. As shown in former years, solar radiation is really not strictly constant, but is variable. The observations were made at Mt. Wilson on every favorable day throughout the period of the stay of the expedition, from May until November, in order to study the progress of this variability of the sun.

In connection with this work, the observatory was equipped with a tower telescope of 75 feet focus in the autumn of the year 1913. This instrument has been employed for the study of the distribution of light over the image of the sun, and the results indicate that this

distribution is variable from day to day. This variability appears to be closely correlated with the variation of the total radiation of the sun revealed by the solar constant investigations. It is confidently hoped that further study of these two interesting phenomena will throw light on the nature of the sun's radiating envelope.

*Sounding balloon work at Omaha.*—In order to more thoroughly confirm our determinations of the solar constant of radiation, measurements were undertaken in connection with the U. S. Weather Bureau at Omaha. Sounding balloons were sent up early in July, 1914, equipped with recording pyrheliometers (fig. 89). The work was in the charge of Mr. L. B. Aldrich, on the part of the Smithsonian Institution, and of Dr. William R. Blair, on the part of the Weather Bureau. Three instruments were sent up and all were recovered. One of these was sent by night as a check on the accuracy of the work, and the other two by day, with the hope of measuring the intensity of the sun's radiation at enormous altitudes. The pyrheliometer was suspended by means of wire 22 meters below three balloons each 1.25 meters in diameter, weighing with the apparatus about 23 pounds. An altitude of 15 miles was reached on July 11 when, as expected, two of the balloons burst by expansion and the third balloon brought the pyrheliometer down in safety near Carson, Iowa.

One of the instruments made a very fine record of solar radiation and fortunately was recovered entirely uninjured, and it has been repeatedly tested and standardized at Washington. The tests are not yet completely finished, but they indicate that three excellent determinations of the solar radiation were made at heights so great that the pressure of the air was extremely small, certainly much less than one-twentieth of that which prevails at sea-level. The results, when reduced to mean solar distance and corrected for all known sources of error, come between 1.8 and 1.9 calories per sq. cm. per minute, with a probable error of about 3 per cent. This result is in close accord with the values of the solar constant of radiation secured by spectrobolometric measurements in former years on Mt. Wilson, Mt. Whitney, Bassour, Algeria, and at Washington.



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# THE JAW OF THE PILTDOWN MAN

(WITH FIVE PLATES)

BY  
GERRIT S. MILLER, JR.



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## THE JAW OF THE PILTDOWN MAN

By GERRIT S. MILLER, JR.

(WITH FIVE PLATES)

About three years ago Mr. Charles Dawson found the right half of an ape-like jaw in undisturbed material five feet below the level of the surrounding country in a gravel pit at Piltdown, Sussex, England. It lay in a depression at the bottom of the third and lowest stratum of the deposit, a band eighteen inches thick consisting of "dark brown ferruginous gravel, with subangular flints and tabular ironstone, pliocene rolled fossils . . . 'eoliths,' and one worked flint" (Dawson and Woodward, 1914, p. 83). This third layer is supposed to be "in the main composed of pliocene drift, probably reconstructed in the pleistocene epoch" (Dawson and Woodward, 1914, p. 85). Within a yard of the same spot, and at precisely the same level, Dr. A. Smith Woodward later dug out a small piece of a human occipital bone. From this pit, and presumably from about the same part of it, other fragments were secured. They represent about half of a human braincase, a pair of human nasal bones, and a simian canine tooth; also teeth of beaver, horse, hippopotamus, rhinoceros, and two kinds of elephant. The human and simian remains were regarded by their discoverers as parts of one individual. On the basis of this assumption, though before the canine tooth and the nasal bones had been found, Dr. Woodward established a genus *Eoanthropus*, characterized by the combination in one skull of a human braincase and a completely ape-like jaw (Dawson and Woodward, April 25, 1913, p. 135).

Few recently discovered fossils have excited more interest than the "Dawn Man of Piltdown," and few have given rise to more discussion (see bibliography at end of this paper). Deliberate malice could hardly have been more successful than the hazards of deposition in so breaking the fossils as to give free scope to individual judgment in fitting the parts together. As a result no less than three restorations of the braincase already exist (see Gregory, 1914, fig. 9), while the canine tooth has been assigned to the right lower mandible and the left upper jaw. The estimates on the capacity of the braincase range from 1,070 to 1,500 cubic centimeters. While there is no doubt that

the braincase, whatever its exact size, represents a member of the family *Hominidæ*, there is wide difference of opinion as to the possibility of joining it with the mandible as parts of one skull. One author regards "this association of human brain and simian features" as precisely what he had anticipated (Smith, 1913, p. 131), while another says that it seems to him "as inconsequent to refer the mandible and the cranium to the same individual as it would be to articulate a chimpanzee foot with an essentially human leg and thigh" (Waters-ton, 1913, p. 319). I cannot find, however, that anyone has yet definitely identified the jaw as that of a member of an existing simian genus, or that any zoologist has attempted a detailed comparative study of this part of "*Eoanthropus*." Dr. Woodward, who regarded the jaw as "almost precisely that of an ape," compared the specimens with young and adult chimpanzee only, while Dr. Gregory chose for his simian standard a female orang. Neither appears to have examined any considerable series of jaws of great apes.

Dr. Aleš Hrdlička has submitted to me a set of casts of the Piltdown fossils, and has suggested that I compare the mandible with the jaws of *Pongidæ* in the United States National Museum. This material includes the mandibles of 22 chimpanzees, 23 gorillas, and about 75 orangs. I have also had access to the series of human skulls in Dr. Hrdlička's custody. Study of these specimens, together with the general collection of primates in the museum, shows that the characters of the mandible and lower molars throughout the order *Anthropoidea* are much more diagnostic of groups than has hitherto been realized. It also convinces me that, on the basis of the evidence furnished by the Piltdown fossils and by the characters of all the men, apes, and monkeys now known, a single individual cannot be supposed to have carried this jaw and skull.

#### ANALYSIS OF THE PUBLISHED OPINIONS THAT THE JAW AND SKULL WERE PARTS OF ONE ANIMAL

The reasons that have been given for associating the jaw with the skull as parts of one animal are of three kinds: distributional, geological, and anatomical. They may be briefly reviewed before the characters of the fossil are taken up in detail.

The distributional evidence is negative. It is thus summarized by Dr. Gregory (1914, p. 194):

The suggestion that while the braincase was human, the lower jaw belonged to another creature, an ape, is not in harmony with what is already known of the fauna and climate of Europe during pleistocene times. Thousands



of mammalian remains of pleistocene age have been discovered in the glacial and interglacial deposits of England and the Continent, but in this highly varied fauna the anthropoid apes have always been conspicuously absent, and there is no reliable evidence that any of the race ever lived in England during the pleistocene epoch.

In this statement two facts are not given their due weight; first, that the paleontological record is so fragmentary that unexpected discoveries need cause no surprise, and second, that a tooth from Taubach, Saxe-Weimar, described and figured by Nehring in 1895 as essentially similar to the first lower molar of a chimpanzee, had already indicated the possible occurrence of the genus *Pan* in Europe during the pleistocene age.

The geological evidence in favor of intimate association of the jaw and braincase is merely that the bones were found close together, at one level, and in a uniform condition of fossilization and water-wearing. These circumstances would give additional reasons for associating remains that presented no zoological difficulties; but when there is obvious incompatibility they do not furnish serious elements of proof. Mr. Dawson's remarks about the deposition of the other mammalian remains found in the same gravel apply with equal force to the skull and the jaw of "*Eoanthropus*": the mere fact that they lay near each other means little. He says (Dawson and Woodward, 1913, p. 151):

The occurrence of certain pliocene specimens in a considerably rolled condition, while the human remains bore little traces of rolling, suggested a difference as to age, but not to the extent of excluding the possibility of their being coeval. The rolled specimens might have entered the stream farther up the river than the human remains, and thus might have drifted into the hole, or pocket, in the river bed, where they were found, during the same age but in different condition . . . . It must be admitted that any attempt to fix any exact zoological date for specimens found in a gravel-bed is fraught with difficulties.

The anatomical reasons are (a) that the jaw "corresponds sufficiently well in size to be referred to the same specimen [as the braincase] without any hesitation" (Dawson and Woodward, 1913, p. 129); (b) that the measurements are "on the whole nearer to those obtained from early human jaws than to those of full-grown apes" (Gregory, 1914, p. 195); (c) that the molars recall human rather than simian teeth in their flattened, worn surfaces and their very thick enamel; and (d) that the condyle, or what remains of it, is more like the average human type than that of an ape. As to the relative size of the jaw and braincase nothing very definite can be said except that

no proof is afforded. To Dr. Woodward the parts appeared to present no discrepancies as to size; but to others who have examined the casts the jaw seems to be too lightly built to correspond with the massive cranial bones. A mandible as heavy as that of the pleistocene *Homo heidelbergensis* would probably be in due proportion; but the Piltdown jaw is even less robust than in well developed recent men. As regards actual dimensions the table on page 20 shows the wide divergence of the Piltdown jaw from both *Homo sapiens* and *H. heidelbergensis*, and its essential agreement with that of recent chimpanzees. Comparisons with *Gorilla* and *Pongo* are not necessary. About the teeth Dr. Woodward went so far as to say: "such a marked regular flattening has never been observed among apes, though it is occasionally met with in lower types of men" (Dawson and Woodward, 1913, p. 132). Yet I find that among nine chimpanzees with teeth at nearly the same stage of wear as in the type, the smooth condition shown by the fossil is closely approached by one individual and exactly matched by another (No. 84655, pl. 1, fig. 1, from cast, and pl. 2, fig. 1", from actual specimen). While the thickness of the enamel is usually greater in *Homo* than in *Pan*, individual variation in both genera is sufficient to make this character, taken by itself, of little diagnostic value. The cast and Dr. Woodward's figures indicate that the Piltdown teeth have enamel differing in no essential feature from that of *Pan* No. 84655 (compare pl. 2, figs. 1" and 2"). As regards the mandible of the fossil it must be remembered that the articular process is worn off to the level where it begins to widen and thicken to form the base of the condyle. From the characters of the part which remains Dr. Gregory reasoned that the condyles were "more slender, less expanded transversely, and supported by more slender pillars of bone" than in the great apes, features which would make the jaw "more like the average human type" (1914, p. 195). This conclusion may be true when the only alternatives considered are *Homo* and *Pongo*, but it does not hold good when the Piltdown jaw is compared with those of *Homo* and *Pan*. The articular process near level of fracture shows more lateral compression than I have been able to find in any specimen of *Homo*, and there is no indication of the deep concavity beneath the inner two-thirds of anterior edge of condyle which is a conspicuous feature of this region in *Homo* as compared with all the great apes. While the outer border of the fracture is unusually long relatively to the posterior and inner borders of the same region as seen in most specimens of *Pan*, the conditions in the Piltdown jaw would be almost exactly

reproduced by similar mutilation of the articular process of No. 174699, an adult female chimpanzee from French Congo. The arguments from anatomy, like those from geology and geography, are thus seen to have little force.

#### MANDIBULAR CHARACTERS OF THE ANTHROPOIDEA

Before trying to decide how much importance should be assigned to the peculiarities of the Piltdown jaw it is necessary to understand the more conspicuous mandibular characters of the *Anthropoidea*.

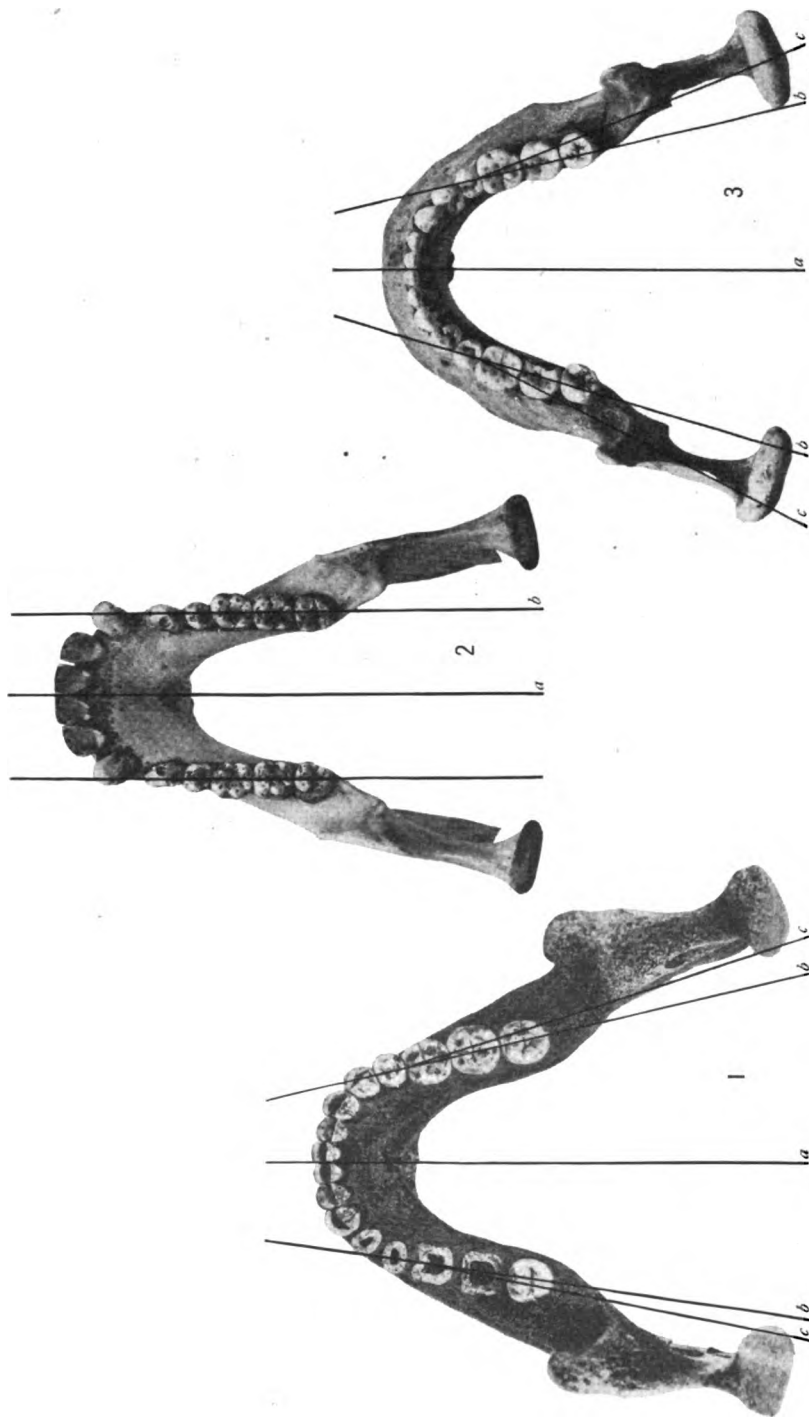
In the *Hominidæ*<sup>1</sup> as in all other *Anthropoidea* the mandibular halves become completely ossified at the symphysis soon after birth. This character distinguishes members of the order from the recent *Lemuroidea*, in all of which the halves remain distinct. Two main peculiarities of the lower jaw and its toothrow separate the *Hominidæ* from other *Anthropoidea* and especially from the great apes. The two halves of the jaw together form a horseshoe-like arch (text fig., 1 and 3, and pl. 3), so broadly rounded in front that the width between the anterior molars is decidedly greater than the distance from the first molar to the symphysis, and so widely open behind that the distance between the condyles (outer borders) is conspicuously greater than that from condylion to symphysis. In other members of the order the arch is so narrow that the distance between the anterior molars never exceeds that from first molar to the symphysis, and the distance between the condyles rarely if ever equals that from condylion to symphysis (text fig., 2, and pl. 4). The toothrow in the *Hominidæ* is narrowed and weakened in front of the molars, the change taking place abruptly with posterior premolar. Each premolar is single rooted, and the crown-area is less than half that of the first molar. The canine never projects conspicuously above the general level of the other tooth summits; its size, form and function are essentially incisor-like. Among the great apes the robust character of the toothrow is carried forward through the large, double-rooted premolars to the strongly functional canine, the point of which rises in males conspicuously above the general level of the other teeth. Together with its anterior weakening the toothrow as a whole is characterized in the *Hominidæ* by a widely arched form corresponding to that of the jaw. The inward curve on each

<sup>1</sup> Including the various living species of *Homo* and the pleistocene, *H. neanderthalensis* King and *H. heidelbergensis* Schoetensack, but excluding, as members of the family *Pongidæ*, the genera *Pithecanthropus* Dubois and *Sivapithecus* Pilgrim.

side begins with the molars, while in the great apes it begins with the premolars or canines. A line joining the middle of posterior border of  $m_2$  with the middle of anterior border of  $m_1$ , will, if continued forward in front of incisors, converge rapidly with the sagittal line similarly extended (text fig., 1 and 3, b). In the great apes and in most of the monkeys except certain smaller South American forms a line passing through middle of posterior border of  $m_2$  and middle of anterior border of  $m_1$  is essentially parallel to the sagittal line (text fig., 2, b). In the *Hominidæ* the inward curve of the tooth-row normally begins with the first lower molar. The axis of this tooth prolonged backward (text fig., 1 and 3, c) diverges rapidly from a line parallel to the sagittal plane and crosses the posterior border of  $m_2$  on outer side of middle; continued still further it passes through the condyle. That of the second tooth similarly prolonged, while diverging slightly from a line parallel to the sagittal plane, passes considerably to inner side of condyle. In all living genera of great apes and in the fossil *Propliopithecus*, *Dryopithecus*, and *Sivapithecus* the axes of the two teeth (text fig., 2, b) lie in one line essentially parallel to the sagittal line and passing further to inner side of condyle than is the case with the axis of  $m_2$  in the *Hominidæ*. The symphyseal region in the *Hominidæ* seldom extends conspicuously behind the level of the incisors, and never bears a marked concavity on its posterior border for insertion of the lingual muscles; in other primates it always extends conspicuously behind level of incisors and it usually bears a marked concavity on its posterior border. The mylohyal ridge is well developed in the *Hominidæ*, but is barely indicated in monkeys and apes.

While sharing those general peculiarities which distinguish other primates from the *Hominidæ*, the three<sup>1</sup> genera of living great apes are readily separable from each other by the details of their mandibular structure. In *Pan* and *Pongo* the digastric muscle is inserted along the lower border of the mandible, rarely extending forward

<sup>1</sup> In the most recent complete work on the order, Elliot's "Review of the Primates," New York (1912), June, 1913, four genera are recognized: *Pongo* Lacépède for the oranges, *Gorilla* I. Geoffroy for the gorillas, *Pseudogorilla* Elliot (l. c. vol. 3, p. 224) for an animal supposed to be the *Gorilla mayema* of Alix and Bouvier, and *Pan* Oken for the chimpanzees. The genus "*Pseudogorilla*" was based on two specimens of true *Gorilla*, an immature male with all the teeth in place but with the basal suture open and the temporal ridges separate (l. c. pl. 32), and a mature female with the basal suture closed and the temporal ridges joined (l. c. pl. 33). Three valid genera are thus left in the group.



TEXT FIG.—Lower jaws (about half natural size) of: 1, *Homo heidelbergensis* (after Schoetensack); 2, *Pan* sp. (No. 176226, southern Kameroun); and 3, *Homo* sp. (No. 278783, Urga, Mongolia). *a* sagittal line, *b* line joining middle of anterior border of *m*<sub>1</sub> with middle of posterior border of *m*<sub>2</sub>, *c* axis of *m*<sub>2</sub>. In No. 2, *c* is not different from *b*. The specimen figured as No. 3 was selected to show wide divergence of *b* and *c* from *a*; in many recent individuals the conditions are essentially as in No. 1. Anomalies are not infrequent.

beyond the extreme posterior edge of the bone. This region of attachment forms a thin, sharply-defined ledge beneath the pit in which the other tongue-muscles are inserted. While the lower border is essentially alike in the two genera the pit is deeper and narrower in *Pan* than in *Pongo* and its upper border is usually well-defined by an abrupt convexity in the posterior profile of the symphysis; the hinder margin of this convexity lying at level of canine or anterior premolar. In both genera the region of temporal muscle-insertion is characterized by the presence of a distinct and narrow ridge curving upward from behind the alveoli and extending to or above the middle of the coronoid process. While they thus agree in certain characters the two genera differ from each other in the form of the symphysis, which, like the entire horizontal ramus, is deeper in *Pongo* than in *Pan*. The base of the articular process in *Pan* is strengthened by a conspicuous ridge extending obliquely downward on the inner side of the mandible. In *Pongo* this ridge is barely indicated. Below the ridge in *Pan* a distinct groove extends upward and backward from the dental foramen; this is scarcely visible in *Pongo*. Turning to *Gorilla* it is seen that the digastric muscle pushes conspicuously forward under posterior border of mandible, so that the ledge beneath the pit is broadly rounded off. The pit is small and ill-defined, and the region which it occupies is carried so far backward by the very gradually sloping symphysis that its upper margin lies at level of posterior premolar. In the region of temporal muscle-insertion the ridge extending upward toward the coronoid process is usually deflected forward below the base of the process. The dental foramen and the region behind it are about as in *Pongo*. The strengthening ridge of articular process is more evident than in *Pongo* but less defined than in *Pan*.

The lower molars in the living primates represent three main types of structure, peculiar respectively to: (a) the American monkeys, (b) the *Hylobatidæ*, great apes,<sup>1</sup> and *Hominidæ*, and (c) the remaining Old World forms. The first type (most clearly shown by *Alouatta*) is essentially that of the more primitive lemur molars (as in *Propithecus*) modified by partial or complete suppression of the paraconid and by various degrees of flattening out of the original triangles, with no addition of new elements. In the second type the paraconid is absent (sometimes a faint trace in *Gorilla*) and there is normally a well-developed talonid. The posterior half of the crown is, as in the first type, basin-shaped; and any transverse ridge which

<sup>1</sup> Also in the extinct genera *Dryopithecus* and *Sivapithecus*.

it may bear extends obliquely between hypoconid and talonid. In the third and most specialized type the paraconid is absent, the talonid is not well developed except in  $m_3$ , and the posterior half of the crown is not basin-shaped. The region occupied by the hollow in the other types is here filled by the bases of the hypoconid and entoconid. Usually the bases of these cusps join to form a high, squarely-transverse ridge.

While the great apes and the *Hominidæ* agree in the fundamental structure of their lower molars each genus shows obvious characters of its own. In *Gorilla* the crowns are low and the cusps high, subterete and more conspicuous than in any of the others. The cingulum on anterior border of  $m_1$  sometimes bears a nodule which may be the last remnant of the paraconid, a character which I have found in this genus only. The talonid of  $m_3$  is very distinct, often larger than the hypoconid and often connected with the hypoconid by a rudimentary oblique transverse ridge. The cingulum at the postero-internal border of crown occasionally bears a minute cusp, while sometimes it is completely transformed into a well-developed single or double cusp. The secondary folding of the enamel is evident, but not sufficiently developed to obscure the plan of cusp-arrangement. A low supplemental cusp is sometimes present between the protoconid and the hypoconid. In *Pan* the depressions between the cusps are not so deep as in *Gorilla*, so that the crowns appear to be less brachydont and the cusps less terete and less conspicuous. The talonid in  $m_3$  is less developed than in  $m_1$  or  $m_2$ , not larger than the hypoconid. Cingulum of postero-internal border often so thickened as to form a supplemental cusp. The secondary folding of the enamel is more evident than in *Gorilla*; it tends to obscure some of the details of the cusp-arrangement. In *Pongo* the cusps take the form of ridge-like elevations at the extreme border of the shallow depression which occupies most of the surface of the crown. The talonid is well developed but is somewhat obscured by the flattening common to all the cusps and by the extremely conspicuous and complicated secondary enamel folding which covers almost the entire surface of the teeth except the summits of the main cusps. In the *Hominidæ* the crowns are slightly less brachydont than in any of the genera of great apes; and the cusps are less distinctly outlined by intervening depressions. Viewed from above they are seen to be less squarely truncate, so that each tooth comes less broadly in contact with the one in front of it (compare pls. 3 and 4). This rounding off at the sides takes place in front at expense of both protoconid and metaconid. There is a similar reduction at the posterior border,

making the entire tooth shorter and more nearly circular in outline than in any of the great apes. The posterior shortening occurs in the region occupied by the talonid and the postero-internal cingulum. The talonid is therefore less constantly present than in the great apes, though it appears to occur normally in  $m_1$  (where it is sometimes divided into two cusps), often in  $m_3$ , and less frequently in  $m_2$ ; rarely it is present in all three teeth. The postero-internal cingulum is seldom a noticeable element. The secondary enamel folding though present is less evident than in any of the great apes. In general the lower molars of the *Hominidæ* may be described as like those of *Pan* but with higher crowns, lower, broader, less sharply-marked-off cusps, less wrinkled enamel, and more rounded-off anterior and posterior borders, the rounding-off behind practically eliminating the postero-internal cingulum and decidedly reducing the talonid or "fifth cusp" (compare pls. 3 and 4).

Two main facts are now evident: that among the living and recently extinct great apes and *Hominidæ* (a) all the more important features of each group remain constant in such widely separated forms as *Homo sapiens* and *H. heidelbergensis*<sup>1</sup> on the one hand and *Pongo*, *Gorilla* and *Pan* on the other, and (b) each known genus is sharply differentiated from all the others by characters visible in the Piltdown jaw.

#### COMPARISON OF THE PILTDOWN JAW AND TEETH WITH THOSE OF OTHER MEMBERS OF THE ORDER

The Piltdown jaw (pl. 1, fig. 2, and pl. 2, fig. 2) admittedly differs from every known mandible of living or extinct members of the family *Hominidæ*. Although broken away a little to the right of the symphysis, it has an abrupt anterior bend which is exactly that of a great ape. The symphyseal region extends conspicuously behind the level of the incisors. The region of the mylohyal ridge is smoothly rounded. The two molars (pl. 2, fig. 2) show no indication of the beginning of a curve in the toothrow. The main axis of the first tooth is continued backward by that of the second in a line passing as far to inner side of condyle as in the *Pongidæ*. In front of the first molar the entire hinder border of the alveolus of  $pm_4$  is plainly visible. It shows that the missing tooth was fully as large as in the great apes

<sup>1</sup> Regarded as a distinct genus by at least two authors: Bonarelli, *Revista Ital. di Paleont.*, Perugia, vol. 15, p. 26, March 15, 1909 (*Palaeanthropus*); and Ameghino, *An. Mus. Nac. de Buenos Aires*, vol. 19 (ser. 3, vol. 12), p. 195, July 27, 1909 (*Pseudhomo*).



and that the toothrow did not become abruptly weakened at the point where this conspicuous change takes place in all known *Hominidæ*. The molars are distinctly less hypsodont<sup>1</sup> than in recent or pleistocene *Hominidæ*. On the outer surface of each tooth there is a trace of a deep sulcus extending downward between the protoconid and the hypoconid nearly to the lower border of the enamel in a manner rarely seen in *Homo* (compare pl. 3 with pl. 2, figs. 2" and 4) but constant in *Gorilla*, *Pan* and *Pongo*. In each tooth there is a large talonid and a postero-internal cingulum, better seen in the photograph (pl. 2, fig. 2") than in the cast (pl. 2, fig. 2'). The anterior border of the crown is squarely truncate; and the general outline of each tooth is unlike that known in any recent or fossil man.

Though its general characters are the same as those of all the living great apes, the Piltdown jaw is readily distinguishable from jaws of *Pongo* and *Gorilla*. There is no trace of the deepening of the horizontal portion of the mandible characteristic of *Pongo*, nor do the teeth show any indication of ridge-like cusps and heavily wrinkled enamel. Enough of the symphyseal region remains to prove that this did not extend backward as in *Gorilla*; while the teeth differ at least as widely from those of *Gorilla* as from those of *Pongo*. Comparison with the mandible of *Pan* brings out no such discrepancies. On the contrary there is agreement in all the features which distinguish *Pan* from the two other genera: in depth of horizontal portion, in form of symphysis, in the ridges on inner side of ascending ramus, and in the peculiarities of dental foramen and the groove behind it. On plates 1 and 2 the Piltdown jaw is compared with casts of the mandibles of two African chimpanzees mutilated in as nearly as possible the same manner. It will be seen that the main peculiarities of the fossil, apart from the large teeth and robust horizontal shaft, lie within the limits of variation shown by these two African specimens. In another African specimen (No. 174710, pl. 5, fig. 2) the depth of shaft as well as that of the ascending branch is essentially equal to that in the fossil (see table of measurements, p. 20). Further details of variation in the mandible of recent chimpanzees are shown in plate 5. The teeth resemble those of certain living chimpanzees in structure, agreeing in all essential features with those of *Pan* No. 176226 from southern Kameroun (compare pl. 2, figs. 2" and 4; allowances must be made for the different degree of wear in the two sets of teeth, and for

<sup>1</sup> In the cast and in the photograph (Woodward, 1915, pl. 4); in the original figure (Dawson and Woodward, 1913, pl. 20) the crowns are represented as essentially human in height.

the fact that the enamel is absent from the antero-internal corner of  $m_1$  in the recent specimen). Their size is greater in proportion to that of the jaw than in any recent material that I have seen. From modern African specimens of *Pan* the Piltdown jaw differs therefore in mere details of proportion and in the actual size of the molar teeth.

The canine tooth found in the Piltdown gravel did not form part of the remains on which the genus "*Eoanthropus*" was based. Yet its interest is so great that it deserves special attention. Of this tooth Dr. Woodward says: it "obviously belongs to the right side of the mandible . . . and its worn face shows that it worked with the upper canine in true ape fashion" (1913: *Nature*, p. 110, *Geol. Mag.*, p. 432), while Dr. Gregory remarks: "Its resemblances are on the whole closer to the left upper canine." Boule (1915), however, leaves the tooth in the lower jaw without comment. As "the enamel on the inner face of the crown has been completely removed by mastication" (Dawson and Woodward, 1914, p. 87) and the worn area is a wide, shallow concavity directly backward and inward, there is no reason to doubt the correctness of the second view. Such mechanical interrelation of the teeth as would produce a worn surface of this kind on a lower canine is not only unknown among primates, but I have been unable to find any mammal with the upper and lower teeth so arranged that it could exist. A concavity on the inner aspect of the lower canine may be present, as in adult *Proptithecus* or in the milk tooth of *Homo*, but not as the result of gouging out by an upper tooth. The fact that its concave surface is worn therefore removes all significance (Dawson and Woodward, 1914, p. 91; Woodward, 1915, p. 23) from the superficial resemblance of the Piltdown tooth to the lower milk canine of man. In all the living great apes the postero-internal surface of the lower canine is convex (see pl. 4, and Woodward, 1915, fig. 8A as compared with fig. 8B). The worn area normally appears first at the summit of the tooth, then extends down the postero-internal limb of the convexity; later it may spread to the antero-internal surface, and in aged individuals may reduce the tooth to a flattened stub. No matter how long a lower canine may have been in use it never assumes the form seen in that of "*Eoanthropus*," nor does it lose all trace of the original convexity of its inner portion. The upper canines, on the other hand, are normally worn away over exactly the same area as in the Piltdown tooth. Among the living great apes, while there is much individual variation in size and form, the canines are larger and higher-crowned in males

than in females. Comparison of the Piltdown tooth with those of males of all three genera and of females of *Gorilla* and *Pongo* show numerous and striking discrepancies which need not be detailed here. On comparison with the left upper canine of adult female *Pan*, however, no such discrepancies are found. The cast of the tooth almost fits the left alveolus of No. 174700, an adult female chimpanzee from French Congo. Its greater size and straighter, more compressed root prevent its taking a wholly natural position in the socket; but when as nearly as possible in place it is in all important respects symmetrical with the canine of the right side and with the cheek-teeth of the left series. The only characters by which I am able to distinguish it from the corresponding tooth of adult female recent chimpanzees are the slightly greater size, the less backward-bent extremity of root, and the greater area and deeper concavity of the worn region on postero-internal aspect of crown. The distinction of root from crown is not so well marked as in recent teeth, but this circumstance is probably due to the incomplete condition of the enamel which Dr. Woodward (Dawson and Woodward, 1914, p. 87) has described.

#### INCOMPATIBILITY OF THE PILTDOWN JAW AND SKULL

Discussion of the relationships of the man represented by the Piltdown braincase to the various living and extinct species of *Homo* does not come within the scope of this paper. Certain characters of the skull-fragments are, however, of special importance in connection with the supposed association of the jaw with those remains.

The occipital bone has been said to approach "a lower [than typically human] grade . . . in the attachment for the neck" (Dawson and Woodward, 1913, p. 132). On comparing it with a few dozen recent human skulls taken at random from the series in the National Museum I find that its peculiarities of form are so exactly matched that none can be regarded as of more than individual importance. The "relatively large extent and flatness of its smooth upper squamous portion" (l. c. p. 128) is completely within the range of variation in modern species of *Homo*. This feature, connected as it is with the upright position of the body, and the consequent shrinking of the area for attachment of the neck-muscles, is one of the family characters of the *Hominidæ*. In the *Pongidæ* a very small smooth area<sup>1</sup> is present in the young above the region of muscle-attachment, but in the adult this area is always encroached on<sup>2</sup> and often obliterated

<sup>1</sup> More noticeable in *Gorilla* and *Pan* than in *Pongo*.

<sup>2</sup> More rapidly and completely in *Gorilla* and *Pongo* than in *Pan*.

by the constantly increasing lambdoid crest. The fact that the squamous portion of the occipital bone is well developed in the fossil therefore indicates wide divergence from the known great apes. Another fancied resemblance to the *Pongidæ* is seen by Boule, who remarks (1915, p. 59) that to him the lower curved line appears to lie relatively nearer to the upper curved line than in recent *Homo*, its position thus more as in *H. neanderthalensis* and still more as in the chimpanzees. The distance between the two lines in the Piltdown skull is 15.5 mm. In two adult skulls of American Indians, one from Illinois (No. 243881) the other from North Dakota (No. 228876), which happened to be lying side by side in one of the exhibition cases it is respectively 14.5 mm. and 27 mm. Among adult chimpanzees I find extremes of 15.5 mm. (No. 174700) and 24.5 mm. (Nos. 84655 and 176227). When a character varies so much in both genera no conclusion can be based on the conditions found in any one skull. Even if a conclusion regarding the lines were justified it would have little meaning in view of the strictly human features of all other parts of the occipital bone.

Aside from the superior maxilla the parts of the skull most directly related to the mandible are: (a) the point of actual contact, (b) the region of origin of the masseter muscle, and (c) that of origin of the temporal muscle. Of these three the first and last are well preserved in the fossils. The glenoid region has been recognized as "typically human in every detail" (Dawson and Woodward, 1913, p. 128). Comparison with many human skulls shows that it presents the characteristically human features of narrow articulating surface and deep fossa in a much more than usual degree of development. Unfortunately the absence of the condyle makes it impossible to know whether the corresponding surface of the Piltdown jaw had the broad and slightly convex form seen in all three genera of living *Pongidæ*; but the part immediately below the fracture shows, in the region over the dental foramen, the highly developed strengthening ridge characteristic of the genus *Pan* (see pl. 1). A slight indication of the ridge is often present in *Homo*; but I have been unable to find a specimen even among those in a set particularly selected to illustrate the variations of human mandibles, in which the structure of this region agrees with living chimpanzees and the Piltdown jaw. The facts are that the Piltdown skull presents extreme human characteristics in the glenoid region calling for correspondingly extreme human conditions of narrow and strongly convex articular surface in the mandible which hinged on it. But this entire mandible, from sym-

physis to base of condyle, is like that of a chimpanzee. Hence in order to fit its articulating surface to that of the skull it would be necessary to imagine an abrupt change of plan in the few millimeters of condyle that have been lost.

Another incongruity is found when the area of origin of the temporal muscle on the skull is compared with that of its insertion on the mandible. Both regions have been carefully described and figured (Dawson and Woodward, 1913, pp. 128, 131, pl. 18, fig. 3, pl. 20, figs. 2a, 2c). The anterior border of the muscle appears to have extended upward on the frontal with somewhat unusual abruptness, an impression that may be heightened by the way in which the bone is broken. The posterior border was not carried very far back on the parietal. In general features the area of origin for the whole muscle is strictly human, and its extent is considerably less than in many of the human skulls with which I have compared it. In all three genera of *Pongida* this area is much greater in proportion to the size of the animal, pushing its way in adult individuals gradually over the braincase to median line, where the muscles of the two sides are often separated merely by a sagittal crest.<sup>1</sup> The area of insertion of the muscle on the Piltdown mandible has not only all the more important general characters peculiar to this region in *Pan*; it has also the individual features which in living members of that genus are connected with the greatest extension of the area of origin of the muscle on the skull. Young chimpanzees show a slight approximation to *Homo* in the form of the area on which the temporal muscle is inserted. The ridge which extends upward from the base of the coronoid process is broad and low, giving this whole region the smoothly convex appearance usually found in members of the family *Hominida*. With increasing age the ridge becomes narrower and the region behind it changes from flat to concave; finally the surface of the main ridge becomes marked by secondary ridgelets which give extreme strength of attachment to the muscle-fibers. This last stage of roughening on the mandible is associated in chimpanzees with the closest approach of the upper end of the muscle to the median line of the braincase and especially with the formation of a sagittal crest. It is well-marked in the Piltdown jaw. In order to associate this jaw with the braincase it would therefore be necessary to assume the existence of an animal related to both *Homo* and *Pan* but with a temporal muscle working on a different mechanical scheme from either; that is, moderate in size and strength at the

<sup>1</sup> Most frequently developed in *Gorilla*, least frequently in *Pan*.

region of origin on the skull and excessively heavy at the mandibular end. That such an animal may have lived cannot be denied ; but nothing so contrary to the facts which are now known need be believed without the evidence of a jaw found in place.

Two other features of the human skull, both connected with the upright position of the body, and both represented by the Piltdown fragments, have an important bearing on the question of the association of the mandible with the braincase. One of these is the form of the basicranial region, the other is that of the nasals. That human skulls differ from those of other primates in the position of the foramen magnum and the occipital condyles appears to have been first clearly recognized by Daubenton, as long ago as 1764.<sup>1</sup> The subject has received attention from many subsequent authors.<sup>2</sup> While some individual variation in this respect is shown by recent man, and the conditions may prove to be less pronounced in the Pleistocene *Homo neanderthalensis* than in living members of the group,<sup>3</sup> the family *Hominidæ* is distinguished from all other mammals by the fact that the occipital region is so produced behind the condyles, while at the same time the anterior maxillary region (including front of lower jaw) is so retracted, that the points of support on the erect upper portion of the vertebral column stand essentially beneath the center of gravity of the skull, thus balancing the head in its characteristic poise. As a result of the maxillary retraction the nasal floor is shortened anteriorly and the nasal aperture is made to open directly forward instead of forward and upward. The nasal bones roofing this modified aperture are normally thrown into a prominence unknown in any monkey or great ape. Whether the maxillary retraction came about primarily as part of a general readjustment of the skull to its upright attitude or through other agencies, the fact remains that this character is not yet known among primates except as part of a set of changes, one result of which is to bring the point of cranial support to the position where it affords the most effective balance. In all primates other than the *Hominidæ* the condyles lie behind the center of gravity and the head is held in place on the oblique or horizontal anterior portion of the

<sup>1</sup> Mém. Acad. Roy. Sci., Paris (1764), pp. 568-577. 1767.

<sup>2</sup> See, for instance, Huxley, Man's Place in Nature, p. 76, 1863 ; Owen Comp. Anat. and Physiol. Vert., vol. 2, p. 554, 1866 ; Broca, Rev. d'Anthrop., Paris, vol. 2, pp. 193-234, 1873 (reprint in Mém. d'Anthrop., vol. 4, pp. 595-641, 1883) ; Papillault, Bull. Soc. Anthropol., Paris, ser. 4, vol. 9, pp. 336-385.

<sup>3</sup> See Boule, Ann. de Paléont., vol. 6, pp. 156-159, 1911 (l'Homme fossile de la Chapelle-aux-Saints, pp. 48-51).

vertebral column by strong muscles;<sup>1</sup> the anterior maxillary region is not retracted, and the nasal bones are flatly sunk into the interorbital region and the upper border of the nasal orifice. In the *Hominidæ* the peculiar position of the condyles is accompanied by special modifications in the floor of the braincase. The area between the foramen magnum and the choanæ is bowed upward, the mastoid process is carried downward and forward until it almost encroaches on the region lying below glenoid notch, and the tympanic plate and entire petro-mastoid are distorted from their primitive form. The temporal bone of "*Eoanthropus*" (Dawson and Woodward, 1913, pl. 19, fig. 2) shows by its exact resemblance to the same bone in *Homo* that this fundamental part of the skull was completely adjusted to the task of supporting a human brain in the upright position. Belief that a primate like the one to which this temporal bone belonged, and living as recently as the late pliocene or early pleistocene, lacked that corresponding balance-adjustment in the maxillary region which is present in all members of the *Hominidæ* actually known, cannot reasonably exist without the evidence of an entire specimen; yet such absence of mechanical unity between the two parts of the skull must be assumed in order to provide the specimen with a long, narrow upper arch to fit the lower jaw<sup>2</sup> (compare pls. 3 and 4). Similarly, in the absence of a specimen showing human nasal bones coexisting with the protruding anterior maxillary region of the great apes, there is every reason to suppose that the Piltdown jaw was not closely associated with this pair of typical human nasals (Dawson and Woodward, 1914, pl. 15, fig. 1) until the deposition of the remains near each other in the old river-bottom. It is not improbable that ancient

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<sup>1</sup> A peculiar instance of approach to a balanced condition of the head is furnished by the South American monkeys of the genus *Saimiri*. Here the back part of braincase protrudes so far that the condyles are made to be nearer the middle of the skull than in any other monkey that I have examined. There is no indication of a general readjustment of the skull, the base of braincase together with the facial region remaining as in related genera.

<sup>2</sup> As the cranial floor between the temporal bone and the median line is not represented by the fragments it is perhaps not safe to assume that the distance from one glenoid to the other was as great as in recent *Homo*. Every feature of the specimen makes it appear probable, however, that such was actually the case. If this human widening existed, the articular surfaces of the corresponding jaw, to accord with the conditions present in all other known primates, should have been wide apart, the jaw should have been strongly arched, and the lower toothrow should have begun to bend inward behind the premolars. Neither the teeth nor the horizontal portion of the Piltdown mandible present any such characters.

fossil forms will be found in which the characters of face, braincase, jaws and teeth are so generalized as to represent a structure that could have given rise to the distinguishing features of both *Hominidæ* and *Pongidæ*. But nothing could be more contrary to the conditions present in all living and fossil *Anthropoidea* now known than the simultaneous occurrence in a pleistocene or recent genus of fully developed fundamental characters elsewhere diagnostic of the two groups.

#### SUMMARY

The Piltdown remains include parts of a braincase showing fundamental characters not hitherto known except in members of the genus *Homo*, and a mandible, two lower molars, and an upper canine showing equally diagnostic features hitherto unknown except in members of the genus *Pan*. On the evidence furnished by these characters the fossils must be supposed to represent: either a single individual belonging to an otherwise unknown extinct genus (*Eoanthropus*), or two individuals belonging to two now-existing families (*Hominidæ* and *Pongidæ*). The fossils are so fragmentary that their zoological meaning will probably remain a subject of controversy. Yet the weight of the difficulties on the two sides is unequal. In order to believe that all the fragments came from a single individual it is necessary to assume the existence of a primate differing from all other known members of the order by combining a braincase and nasal bones possessing the exact characters of a genus belonging to one family, with a mandible, two lower molars, and an upper canine possessing the exact characters of a genus belonging to another. Thus must be associated in a single skull: (a) one type of jaw with another type of glenoid region, (b) one type of temporal muscle-origin with another type of temporal muscle-insertion, (c) a high degree of basicranial adjustment to the upright position with absence of that corresponding modification in the lower jaw called for by all that is now actually known of the structure of the braincase and mandible in primates, and (d) a protruding lower jaw with a form of nasal bone not elsewhere known except in connection with a retracted upper dental arch. In each instance the opposed characters are sharply defined and easily recognizable in the fossils; while in no single feature is there any trace of the blending of the two types. On the other hand the assumption that the skull and jaw belonged respectively to a man and a chimpanzee carries with it only two difficulties: (a) that of the deposition within a few feet of each other of the remains of two animals whose bones are rarely found in gravel



pits, and (b) that of the supposed absence of chimpanzees from the European pleistocene faunas. Concerning the first nothing can be said, except that those local conditions which caused the deposition of one specimen near a given spot might be expected to act in about the same way with another. The second is at least partly met by the fact that a tooth described and figured as not certainly distinguishable from the first lower molar of a chimpanzee has been found in the pleistocene of Germany. Until the discovery of further material it seems proper to treat the case as a purely zoological problem by referring each set of fragments to the genus which its characters demand.

#### THE BRITISH PLEISTOCENE CHIMPANZEE

Accepting the conclusions (a) that each set of the Piltdown fragments shall be treated according to the existing characters, and (b) that the characters of the lower jaw are those of a member of the genus *Pan*, it becomes necessary to distinguish the British pleistocene chimpanzee from the living African species. No special fragment was designated by Dr. Woodward as the type specimen of *Eoanthropus dawsoni*. As the species was referred to the family *Hominidae* I now restrict the name to the human elements of the composite, selecting as type the temporal bone (Quart. Journ. Geol. Soc. London, vol. 69, pl. 19, fig. 2). For the chimpanzee represented by the mandible with its first and second molar teeth I propose the name:

#### **PAN VETUS, sp. nov.**

(Pl. 1, fig. 2, pl. 2, fig. 2)

*Diagnosis.*—General characters of mandible and of first and second lower molars as in living species of *Pan* from French Congo and southern Kameroun, but horizontal ramus more robust and teeth larger.

*Measurements.*—In the table (page 20) the measurements of the type (from cast) are compared with those of seven mandibles of *Pan* from French Congo and Kameroun, among which are represented the maximum and minimum dimensions for the entire National Museum series of adults. Only one of these individuals contrasts noticeably with the type in the worn condition of the molar crowns. For convenience of further comparisons I have added the measurements of *Homo heidelbergensis* (from cast) and of three specimens of modern *Homo*, one extremely large, another medium in size and the third rather small.

TABLE OF MEASUREMENTS.

Locality.	Number.	Sex.	Length of mandible at alveolar level from posterior border to symphysis.	Distance from posterior border of mandible to front of m. (alveolus).	Diameter of ascending ramus at alveolar level.	Depth of ascending ramus from lowest point of sigmoid notch.	Depth of horizontal portion at middle of m.	Depth of horizontal portion at middle of m.	Width of horizontal portion at middle of m.	Greatest width of horizontal portion below middle of m.	Combined alveolar length of three molars.	Crown of first molar.	Crown of second molar.	Worn condition of teeth as compared with those of <i>Pan vetus</i> .
								<i>Pan sp. (recent).</i>						
French Congo .....	174707	♀	109.4	68.0	40.6	....	21.2	23.0	14.8	10.6	31.4	10.2X9.6	11.0X9.8	Slightly less.
French Congo .....	174701	♂	113.6	72.0	44.0	49.0	29.4	27.6	16.6	12.9	32.0	10.8X10.0	11.2X9.8	Distinctly less.
S. Kameroun .....	176229	♀	117.4	77.8	51.2	40.6	27.6	30.2	17.0	13.8	32.0	10.0X9.0	11.0X10.0	Slightly more.
French Congo .....	174699	♂	120.4	78.4	47.6	47.4	27.2	27.7	16.8	15.2	34.6	.....	.....	About the same.
French Congo .....	174710	♀	123.3	80.4	50.6	62.0	28.0	30.6	16.4	13.0	32.6	10.0X9.6	10.8X10.0	Noticeably more.
S. Kameroun .....	176235	♂	115.7	80.0	51.6	52.4	24.2	26.4	17.2	14.6	33.8	10.6X10.6	11.0X11.6	Slightly less.
French Congo .....	174704	♂	125.8	81.0	52.0	61.2	27.2	28.2	17.5	14.8	34.0	11.0X9.4	11.0X10.6	Distinctly less.
Minimum .....			109.4	68.0	40.6	47.4	21.2	23.0	14.8	10.6	31.4	10.0X9.0	10.8X9.8	
Maximum .....			125.8	81.0	52.0	62.0	29.4	30.6	17.5	15.2	34.6	11.0X10.6	11.0X11.6	
							<i>Pan vetus (pleistocene).</i>							
England .....		♀? *120±	76.8	76.8	47.0	61.0	29.8	31.0	21.2	14.8	39.0	12.5X10.5†	13.0X11.0†	
							<i>Homo heidelbergensis (pleistocene).</i>							
Germany .....			120.5	92.2	58.8	61.4	30.7	34.6	23.0	19.0	35.8	11.8X11.4	12.6X12.2	
							<i>Homo sp. (recent).</i>							
			101.8	75.6	46.8	53.6	33.4	37.5	20.8	20.2	35.2	12.6X11.6	12.4X11.0	
			95.0	71.4	45.3	62.0	35.4	42.3	20.4	18.8	36.4	12.2X11.8	12.6X11.4	
			90.2	66.2	36.2	42.2	23.4	27.5	15.2	11.5	28.6	10.2X9.8	9.6X9.0	

\* Estimated. Error probably less than 5 mm.

† Dr. Woodward's measurements are respectively: 11.5X9.5 and 12.0X10.0 mm. Apparently he took into consideration the flattened surface only.

*Remarks.*—Within the limits of the generic characters recent chimpanzees, like other great apes, show many variations the nature of which is imperfectly understood. Numerous species have been described<sup>1</sup> but their cranial peculiarities, if such exist, are not yet known. Among the skulls in the National Museum series I have been unable to find satisfactory characters by which to distinguish local forms.

Comparing the Piltdown mandible with those from Kameroun and French Congo I have found no constant features other than those already mentioned. That part of mandible in front of  $m_1$  is, for instance, shorter than in the two African jaws figured on plate 1; but No. 174710 (pl. 5, fig. 2) from French Congo has this region fully as short and nearly as deep as the type. In *Pan vetus* the thickened area which extends downward on outer side of mandible in continuation of the base of the coronoid process is more prominent than in most African specimens. It contributes to the robustness of the jaw in that region, and stands out noticeably beyond the level of the lower edge when the mandible is viewed at a certain angle from above. In African specimens this thickening is usually not sufficient to project noticeably beyond the level of the angular margin, but in No. 176235 from southern Kameroun it does so almost as much as in *Pan vetus*. The angle of the jaw is more evenly rounded off in *Pan vetus* than in most African chimpanzees that I have seen. These usually show a slight concavity below the angular region and another, often the more pronounced of the two, above it. In No. 174710 (pl. 5, fig. 2) from French Congo a very slight wearing away of the edge of the bone such as appears to have taken place in the Piltdown jaw would exactly produce the outline of the type. The teeth appear to be more diagnostic than the jaw, as I have been unable to find any African specimen in which they equal those of *Pan vetus* in size.

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<sup>1</sup> See Elliot, *Rev. Primates*, vol. 3, pp. 229-254, June, 1913, and Matschie, *Sitzungsber. Gesellsch. naturforsch. Freunde*, Berlin, 1914, pp. 327-335, July, 1914.

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Announcement that: Excavations in Sussex undertaken by an anthropological student have brought to light fragments of a human skull detailed description of which will be presented at a meeting of the Geological Society to be held on December 18.

ANONYMOUS. Discovery of Human Skull (Early Pleistocene?) near Lewes. Nature, vol. 90, p. 390. December 5, 1912.

A "note" announcing Mr. Dawson's discovery of the Piltdown remains.

ANONYMOUS. A Palaeolithic Skull. The Times, London, December 19, 1912, p. 4.

Principally an abstract of paper presented at meeting of Geological Society, December 18. No name printed.

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Brief synopsis of history and characters of Piltdown man. No name printed.

ANONYMOUS. The Piltdown Skull. Nature, vol. 91, pp. 640-641. August 21, 1913.

Account of the discussion by members of the anatomical section, International Congress of Medicine.

ANTHONY, R. Les restes humains fossiles de Piltdown (Sussex). Revue Anthropologique, vol. 23, pp. 293-306. September, 1913.

Accepts the association of the skull with jaw: "Ce qui pourrait le rendre vraisemblable c'est que, chez les jeunes Anthropoïdes nous voyons précisément associée à une boîte crânienne sensiblement sphérique une mâchoire à menton fuyant," p. 304. Regards the formation of a new genus as not justified: "En raison de sa capacité crânienne toute humaine il me semble cependant contre-indiqué de le séparer du genre *Homo*. Le nom spécifique d'*Homo dawsoni* me semble devoir être préféré à celui d'*Eoanthropus dawsoni* . . ." (p. 305).

BOULE, MARCELLIN. L'Homme fossile de la Chapelle-aux-Saints. Annales de Paléontologie, vol. 6, pp. 111-172, 1911, vol. 7, pp. 21-56, 85-192, 1912, vol. 8, pp. 1-70. 1913.

*Eoanthropus* frequently mentioned, pp. 245-265, but at this time known to the author from descriptions only. (See next title.)

BOULE, MARCELLIN. La Paléontologie humaine en Angleterre. L'Anthropologie, vol. 26, pp. 1-67, figs. 1-21. April, 1915.

*Eoanthropus*, pp. 39-67. Accepts association of skull with jaw, though recognizing that jaw is exactly that of a chimpanzee, and that it would have been described as *Troglodytes dawsoni* if found alone (p. 60). Admits that the presence of a pliocene anthropoid ape in western Europe would be nothing extraordinary (p. 62). Regards the creation of a new genus as unnecessary. Criticizes Waterston's view that jaw did not belong with skull: "Cet argument, d'ordre purement anatomique, n'est donc pas sans valeur. Mais il a le tort d'être imprégné d'un vieux parfum cuviérin et de reposer trop exclusivement sur les données morphologiques tirées de l'Homme actuel. Or, les paléontologistes savent combien la nature est fertile en combinaisons imprévues; elle a pu associer d'autant plus facilement un condyle et une fosse glénoïde d'Homme à une mâchoire de Singe que, mécaniquement et physiologiquement, cette association ne paraît pas absurde. Il semble que, dans l'évolution d'une tête osseuse, quand la face diminue, la mandibule diminue plus lentement, ne suivant en quelque sorte que de loin le mouvement de retrait" (p. 62).

DAWKINS, BOYD. [Discussion of the Piltdown skull.] Abstr. Proc. Geol. Soc. London, session 1912-13, pp. 23-24. December 28, 1912. (See also Quart. Journ. Geol. Soc. London, vol. 69, pp. 148-149. March, 1913, issued April 25, 1913.)

Accepts association of skull and jaw. Concludes that *Eoanthropus* is "a missing link between man and the higher apes, appearing at that stage of the evolution of the higher mammalia in which it may be looked for—in the pleistocene age. The modern type of man had no place in this age."

DAWSON, CHARLES, and WOODWARD, ARTHUR SMITH. On the discovery of a palaeolithic human skull and mandible in a flint-bearing gravel overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex). Abstr. Proc. Geol. Soc. London, session 1912-13, pp. 20-22. December 28, 1912.

Abstract of history and characters. Name not printed. "... it may be regarded as representing a hitherto unknown genus and species, for which a new name is proposed."

DAWSON, CHARLES, and WOODWARD, ARTHUR SMITH. On the discovery of a palaeolithic human skull and mandible in a flint-bearing gravel overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex). Quart. Journ. Geol. Soc. London, vol. 69, pp. 117-124, pls. 15-21 (wash drawings; for photographs see Woodward, 1915), figs. 1-10. March, 1913. Read December 18, 1912; issued April 25, 1913.

DAWSON, CHARLES, and WOODWARD, ARTHUR SMITH. Supplementary note on the discovery of a palaeolithic human skull and mandible at Piltdown (Sussex). Abstr. Proc. Geol. Soc. London, session 1913-1914, pp. 28-29. December 31, 1913.

"In shape, the canine resembles the milk canine of man and that of the apes more closely than it agrees with the permanent canine of any known ape. In accordance with a well-known palaeontological law, it therefore approaches the canine of the hypothetical Tertiary Anthropoids more nearly than any corresponding tooth hitherto found."

DAWSON, CHARLES, and WOODWARD, ARTHUR SMITH. Supplementary note on the discovery of a palaeolithic human skull and mandible at Piltdown (Sussex). Quart. Journ. Geol. Soc. London, vol. 70, pp. 82-93, pls. 14-15, figs. 1-3. April 25, 1914.

"It results, therefore, from these comparisons that, among known Upper Tertiary and Recent Anthropoids, the permanent lower canine of *Eoanthropus* agrees more closely in shape with the milk-canine both of man and of the apes than with the corresponding permanent tooth in either of these groups. It is also obvious that the resemblance is greater between *Eoanthropus* and *Homo* than between the former and any known genus of apes. In other words, the permanent tooth of the extinct *Eoanthropus* is almost identical in shape with the temporary milk-tooth of the existing *Homo*. Hence it forms another illustration of the well-known law in mammalian palaeontology, that the permanent teeth of an ancestral race agree more closely in pattern with the milk teeth than with the permanent teeth of its modified descendants" (p. 91).

DUCKWORTH, DR. [Discussion of the Piltdown skull]. Abstr. Proc. Geol. Soc. London, session 1912-1913, p. 24. December 28, 1912. (See also Quart. Journ. Geol. Soc. London, vol. 69, p. 149. March, 1913. Issued April 25, 1913.)

"It was justifiable to associate the various fragments as parts of one human skull, and the presence of so many simian characters in one and the same specimen was a point of great significance."

ELLIOT, G. F. SCOTT. Prehistoric Man and His Story. London and Philadelphia, 1915, pp. I-XIV, 1-398, 64 illustr. and diagrams.

Piltdown woman, pp. 125-129. "The jaw in some respects resembles that of a young chimpanzee . . . . Though there are a few distinctively ape-like characters, most of those points in which the skull differs from modern man can be detected in one or another of the primitive races. If so, she is the only representative known of one of the very earliest strains of mankind, perhaps the very first known of the original 'generalized world-ranging type' from which all other varieties were derived" (pp. 128-129).

FORESTIER, A. Periods of Prehistoric Man: Pleistocene Types, Weapons and Tools. Illustrated London News, vol. 143, pp. 296-297. Numerous figures. August 23, 1913.

Accepts Keith's reconstruction of jaw.

GIUFFRIDA-RUGGERI, V. Dawson (Ch.) e Woodward (A. S.). On the discovery of a palaeolithic skull and mandible in a flint-bearing gravel overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex). Arch. Antrop. e Etnol., Firenze, vol. 43, pp. 184-186. 1913.

Review. Doubts the distinctness of the genus *Eoanthropus* from *Homo*. "In ogni caso sin d'ora appare che l'*'Eoanthropus'* non è un fossile ben chiaro, como nuovo genere, e che molto probabilmente rientrerà nei fossili già noti: forse il Gibraltar è il più vicino."

GREGORY, WILLIAM KING. The Dawn Man of Piltdown, England. Am. Mus. Journal, vol. 14, pp. 189-200, figs. 1-11. May, 1914.

Accepts association of skull with jaw. Compare fig. 5 with text fig. in present article.

HADDON, A. C. *Eoanthropus dawsoni*. Science, n. s. vol. 37, pp. 91-92. January 17, 1913.

HRDLIČKA, A. The most ancient skeletal remains of man. Ann. Rep. Smiths. Inst., 1913, pp. 491-552, pls. 1-41, figs. 1-12.

*Eoanthropus*, pp. 500-509. "It represents doubtless one of the most interesting finds relating to man's antiquity, though seemingly the last word has not yet been said as to its date and especially as to the physical characteristics of the being it stands for."

IRVING, A. Some recent work on later quarternary geology and anthropology, with its bearing on the question of "pre-boulder-clay man." Journ. Royal Anthropol. Inst. Great Britain and Ireland, vol. 44, pp. 385-393. July-December, 1914.

"The hominid *Eoanthropus dawsoni* (Piltdown) is undoubtedly of pre-chalky boulder-clay age" (p. 393).

KEITH, A. [Discussion of the Piltdown skull.] Abstr. Proc. Geol. Soc. London, session 1912-13, p. 23. December 28, 1912. (See also Quart. Journ. Geol. Soc. London, vol. 69, p. 148. March, 1913. Issued April 25, 1913.)

Accepts association of skull with jaw but considers that reconstruction of jaw is made to be too much like chimpanzee.

KEITH, A. Ape-man or Modern Man? The two Piltdown skull reconstructions. Illustrated London News, vol. 143, p. 245, figs. 1-6. August 16, 1913.

Jaw reconstructed to hold a human dentition.

KEITH, A. Ape-man or Modern Man? The two Piltdown skull reconstructions. The case for Professor Arthur Keith's reconstruction. Illustrated London News, vol. 143, p. 282. August 23, 1913. 4 figures.

Reconstruction of jaw to resemble as nearly as possible that of *Homo*.

KEITH, A. The Piltdown Skull and Brain Cast. *Nature*, vol. 92, pp. 197-199, figs. 1-3. October 16, 1913.

KEITH, ARTHUR. The Piltdown Skull and Brain Cast. *Nature*, vol. 92, p. 292. November 6, 1913.

KEITH, ARTHUR. The Piltdown Skull and Brain Cast. *Nature*, vol. 92, pp. 345-346. November 20, 1913.

KEITH, A. [Discussion of new reconstruction of skull of *Eoanthropus*.] *Abstr. Proc. Geol. Soc. London*, session 1913-14, p. 30. December 31, 1913. (See also *Quart. Journ. Geol. Soc. London*, vol. 70, p. 98, April 25, 1914.)

Admits difficulties in associating jaw, skull and canine as parts of one individual, but regards all as representing one species: "Two other difficulties he had encountered were (1) the presence of a pointed projecting canine in the jaw and an articular eminence at the glenoid fossa of the skull; and (2) a much-worn canine tooth in a jaw in which the third molar tooth—according to the published X-ray photograph of the Piltdown mandible—was not completely erupted. (See Underwood, December 31, 1913.) He agreed that all three parts—skull, jaw, and canine tooth—must be assigned to *Eoanthropus*, but he was not convinced that they could all belong to the same individual."

KEITH, A. Problems relating to the teeth of the earlier forms of prehistoric man. *Proc. Roy. Soc. Medicine*, vol. 6, Odont. sect., pp. 103-119, figs. 1-10. 1913.

Piltdown mandible, pp. 116-119.

KEITH, ARTHUR. The Significance of the Discovery at Piltdown. *Bedrock*, vol. 2, pp. 435-453, figs. 1-3. January, 1914.

"There is one way out of this difficulty—that suggested by Sir E. Ray Lankester and urged by Professor Waterston—namely, that the mandible and skull are parts of different kinds of beings; the mandible that of some unknown anthropoid, and the skull that of a primitive form of man. When we seek to get out of our difficulty in this way we raise others. The molar teeth in the Piltdown mandible are essentially human in appearance; the texture of the mandible is similar to that of the skull. The markings for the temporal muscle, which acts on the jaw, are different to any ever seen in a human skull and indicate that the mandible should be of a peculiar character—such as has been found."

KEITH, ARTHUR. The reconstruction of fossil human skulls. *Journ. Royal Anthropol. Inst. Gt. Brit. and Ireland*, vol. 44, pp. 12-31, figs. 1-16. January-June, 1914.

Describes process of reconstructing the Piltdown skull.

KEITH, ARTHUR. *The Antiquity of Man*. London and Philadelphia, 1915, (preface dated July), pp. I-XX, 1-519, 189 figures and diagrams.

Piltdown skull, pp. 293-511; the most elaborate discussion yet published. Account of mandible with special reference to simian features, pp. 430-452 (drawings reproduced in figs. 165 and 167 should be compared with photographs in present article). Account of teeth, pp. 453-457. Conclusions: "Thus in our scrutiny and reconstruction of the Piltdown mandible, although we have come across many details of structure which seem to suggest that it formed part of an anthropoid rather than a human being, we have met with no feature which clearly debars it from being placed with the skull . . . our difficulties are infinitely greater if we try to allocate the skull to a human being and the mandible to an unknown kind of anthropoid (p. 453) . . . Thus in the manner in which it has become worn by use the Piltdown canine differs from all known human and anthropoid [mandibular] teeth (p.

459). The molar teeth leave us in no doubt; they are human. If the question is asked: What are the characters of these teeth which are so essentially human? it must be confessed that a direct and explicit answer is not easily returned . . . . However we may waver about the Piltdown mandible, the clear direct evidence of the molar teeth comes ever to our aid" (pp. 469-470). Places *Eoanthropus* on a line distinct from those leading to *Homo heidelbergensis* and *H. neanderthalensis* on the one hand and to modern man on the other (p. 501). (See Pilgrim and Sutcliffe.) "That we should discover such a race [human, with canine teeth pointed, projecting, and shaped as in anthropoid apes], has been an article of faith in the anthropologist's creed ever since Darwin's time" (p. 459). Received too late for notice in body of text.

LANKESTER, RAY. [Discussion of the Piltdown skull.] Abstr. Proc. Geol. Soc. London, session 1912-13, pp. 22-23. December 28, 1912. (See also Quart. Journ. Geol. Soc. London, vol. 69, pp. 147-148. March, 1913. Issued April 25, 1913.)

"He did not consider it certain that the lower jaw and the skull belonged to the same individual."

MACCUDY, G. G. Ancestor Hunting: the Significance of the Piltdown Skull. Amer. Anthrop. n. s. vol. 15, pp. 248-256. April-June, 1913.

MOIR, J. REID. The Piltdown Skull. The Times, London, December 25, 1912, p. 8.

"In my opinion, then, Mr. Dawson is to be congratulated on having made the immensely important discovery of the remains of one of the beings who made the eolithic flint implements." (See Sutcliffe.)

MUNRO, ROBERT. Prehistoric Britain (Home University of Modern Knowledge), pp. I-VI, 1-256, figs. 1-24. 1913.

*Eoanthropus*, pp. 25, 52-55, 70-74, figs. 8-9. Accepts association of skull with jaw.

NEHRING, A. Ueber einen menschlichen Molar aus dem Diluvium von Taubach bei Weimar. Zeitschr. für Ethnologie, vol. 27, pp. 573-577, figs. 1-4. October, 1895.

The author regards this tooth as human, but is unable to compare it with anything except the first lower molar of a chimpanzee. According to the figures it almost exactly resembles the corresponding tooth of *Pan vetus*. Size not so great: 11.7 x 9.9 mm. In the actual specimen the similarity to *m<sub>1</sub>* of *Pan* is said to be still greater than in the drawing.

PILGRIM, GUY E. New Siwalik primates and their bearing on the evolution of man and the Anthroidea. Rec. Geol. Surv. India, vol. 45, pp. 1-74, pls. 1-4, figs. 1-2.

Accepts association of skull with jaw and places *Eoanthropus* on line leading to *Homo neanderthalensis*. (See Keith, 1915, and Sutcliffe.)

PUCCIONI, NELLO. Appunti intorno al frammento mandibolare fossile di Piltdown (Sussex). Archivio per l'Antropologia e la Etnologia, vol. 43, pp. 167-175. 1913.

Jaw and skull not from one individual. Jaw more like Neanderthal man than like chimpanzee. "Mi sembra pertanto indubitabile che la mandibola in questione appartenga ad un tipo rozzo, a mio parere più simile al tipo di Neanderthal che non al *Troglodites* e mi sembra altresì che non si possa considerare probabile che i caratteri grossolani di questa mandibola si accompagnassero ai caratteri relativamente fini (assenza dell'arcate sopraorbitarie, fronte alta e dritta ecc.) dei frammenti cranici che le furono rinvenuti accanto: ond'è, che concordemente a quanto pensano due eminenti scienziati inglesi (il Lankester e il Waterston), io sono di opinione che la mandibola ed il cranio abbiano probabilmente appartenuto a due individui distinti" (p. 175).



PUCCIONI, NELLO. Morphologie du maxillaire inférieur. *L'Anthropologie*, vol. 25, pp. 291-321, figs. 1-3. 1914.

Reaffirms view that Piltdown mandible is less simian than Smith Woodward makes it appear (p. 315).

PYCRAFT, W. P. The most ancient inhabitant of England: the newly-found Sussex Man. *Illustrated London News*, vol. 141, p. 958. December 28, 1912.

PYCRAFT, W. P. Ape-Man or Modern Man? The two Piltdown skull reconstructions. The case for Dr. A. Smith Woodward's reconstruction. *Illustrated London News*, vol. 143, p. 282. August 23, 1913. Four figures.

"But no one competent to express an opinion would accept this interpretation [that skull is man and jaw ape]."

ROBINSON, LOUIS. The Story of the Chin. *Knowledge n. s.*, vol. 10, pp. 410-420. November, 1913. (Reprinted in *Smithsonian Report for 1914*, pp. 599-609, pls. 1-12, 1915.)

Piltdown jaw (symphyseal region) figured (pl. 7) but not mentioned in the text.

SCHWALBE, G. Kritische Besprechung von Boule's Werk: "L'Homme fossile de la Chapelle-aux-Saints." *Zeitschr. für Morphologie und Anthropologie*, vol. 16, pp. 227-610. January 31, 1914.

Piltdown skull and jaw, pp. 603-4. Not willing to accept the suggestion that skull and jaw did not belong to one individual, but considers the facts too uncertain to form basis of positive opinion.

SHATTOCK, S. G. Morbid thickening of the calvaria; and the reconstruction of bone once abnormal; a pathological basis for the study of the thickening observed in certain pleistocene crania. Seventeenth International Congress of Medicine, London, 1913, sect. 3, pt. 2, pp. 3-46, pls. 1-4, text figs. 1-3. 1914.

Piltdown skull, pp. 42-46. "But to conclude. Without making any dogmatic statement, certain details of the Piltdown calvaria suggest the possibility of a pathological process having underlain the thickened condition" (p. 46). Accepts association of skull with jaw, and regards the third lower molar as unerupted (p. 43). See Underwood, December 31, 1913.

SMITH, G. ELLIOT. Appendix [to paper by Dawson and Woodward]. *Abstr. Proc. Geol. Soc. London*, session 1912-13, p. 22. December 28, 1912.

Abstract of paper mentioned under next title. The last paragraph of abstract does not occur in full account. It is: "There are no grounds whatever for supposing that this simian jaw and human brain-cast did not belong to one and the same individual, who was probably a right-handed female."

SMITH, GRAFTON ELLIOT. Preliminary report on the cranial cast [of the Piltdown skull]. *Quart. Journ. Geol. Soc. London*, vol. 69, pp. 145-147. March, 1913. Issued April 25, 1913.

SMITH, G. ELLIOT. The Piltdown Skull. *Nature*, vol. 92, p. 131. October 2, 1913.

Accepts association of skull with jaw and adds: "The small and archaic brain and thick skull are undoubtedly human in character, but the mandible, in spite of the human molars it bears, is more simian than human. So far from being an impossible combination of characters, this association of brain and simian features is precisely what I anticipated in my address to the British Association at Dundee (*Nature*, September 26, 1912, p. 125), some months before I knew of the existence of the Piltdown skull, when I argued that in the evolution of man the development of the brain must have led the way. The

growth in intelligence and in the powers of discrimination no doubt led to a definite cultivation of the aesthetic sense, which, operating through sexual selection, brought about a gradual refinement of the features."

SMITH, G. ELLIOT. The Piltdown Skull and Brain Cast. *Nature*, vol. 92, pp. 267-268. October 30, 1913.

SMITH, G. ELLIOT. The Piltdown Skull and Brain Cast. *Nature*, vol. 92, pp. 318-319. November 13, 1913.

SMITH, G. ELLIOT. The controversies concerning the interpretation and meaning of the remains of the dawn-man found near Piltdown. *Nature*, vol. 92, pp. 468-469. December 18, 1913.

"There is definite internal evidence that the jaw is not really an ape's; the teeth it bears are human . . . ."

SMITH, G. ELLIOT. On the exact determination of the median plane of the Piltdown skull. *Abstr. Proc. Geol. Soc. London*, session 1913-14, p. 29, December 31, 1913. (See also *Quart. Journ. Geol. Soc. London*, vol. 70, pp. 93-97, figs. 4-6, April 25, 1914.)

SMITH, G. ELLIOT. The controversies concerning the interpretation and meaning of the remains of the dawn-man found near Piltdown. *Mem. and Proc. Manchester Lit. and Philos. Soc.*, vol. 58, pp. VII-IX. March 31, 1914.

"That the jaw and cranial fragments . . . belonged to the same creature there had never been any doubt on the part of those who have seriously studied the matter" (p. VIII). The author believes that: "When man was first evolved the pace of evolution must have been phenomenally rapid." He alludes to "the turmoil incident to the inauguration of the Pleistocene Period" (p. IX).

SMITH, G. ELLIOT. The Significance of the Discovery at Piltdown. *Bedrock*, vol. 3, pp. 1-17. April, 1914.

A detailed criticism of Professor Keith's views.

SOLLAS, W. J. *Ancient Hunters and their Modern Representatives*. Ed. 2, London, 1915, pp. I-XIV, 1-591, 314 figs.

Piltdown man, pp. 49-56. "Some have regarded such a being as an improbable monster and have suggested that the jaw may not have belonged to the skull, but to a true ape. The chances against this are, however, so overwhelming that the conjecture may be dismissed as unworthy of serious consideration. Nor on reflection need the combination of characters presented by *Eoanthropus* occasion surprise. It had, indeed, been long previously anticipated as an almost necessary stage in the course of human development" (p. 54).

SUTCLIFFE, W. H. A criticism of some modern tendencies in prehistoric anthropology. *Mem. & Proc. Manchester Lit. and Philos. Soc.*, vol. 57, no. 7, pp. 1-25, pls. 1-2. June 24, 1914.

Skull and jaw "undoubtedly belonging to the same individual." *Eoanthropus* placed on line leading to *Homo sapiens*, pl. 1. (See Keith, 1915, and Pilgrim.) Eoliths produced by natural agencies. (See Moir.)

THACKER, A. G. The Significance of the Piltdown Discovery. *Science Progress*, vol. 8, pp. 275-290. October, 1913.

Accepts association of skull with jaw.

TYRELL, G. W. The Sussex Skull. *Knowledge*, vol. 36, p. 61, February, 1913.

Account of paper by Dawson and Woodward. Name *Eoanthropus* not printed.

UNDERWOOD, ARTHUR S. The Piltdown Skull. *British Journal of Dental Science*, vol. 56, pp. 650-652, 3 plates (not numbered). October 1, 1913.

Accepts association of skull with jaw, but shows by means of radiographs the exact similarity of the jaw to that of a chimpanzee. Does not especially discuss the characters of the molars.

UNDERWOOD, A. S. [Discussion of "Supplementary Note" on Piltdown skull.] *Abstr. Proc. Geol. Soc. London*, session 1913-14, pp. 30-31. December 31, 1913. (See also *Quart. Journ. Geol. Soc. London*, vol. 70, p. 99. April 25, 1914.)

"The sockets of the third molar were not those of an erupting tooth, the roots had been quite completed, and the tooth was in its final position at death." (See Keith, December 31, 1913.)

VRAM, U. G. Le ricostruzioni dell' *Eoanthropus Dawsoni*, Woodward. *Boll. Soc. Zool. Ital.*, Roma, ser. 3, vol. 2, pp. 195-198. 1913.

Accepts association of jaw with skull, but considers that a new species should not have been based on such incomplete material.

WALKHOFF, DR. Entstehung und Verlauf der phylogenetischen Umformung der menschlichen Kiefer seit dem Tertiär und ihre Bedeutung für die Pathologie der Zähne. *Deutsche Monatsschr. für Zahnheilkunde*, vol. 31, pp. 947-979, figs. 1-9. December, 1913.

Piltdown jaw, pp. 971-979. Accepts association of skull and jaw. Regards the jaw as a confirmation of his views on the origin of the chin. "Das Kieferbruchstück von Piltdown wird damit zu einem neuen, sehr wichtigen Beweise für meine Theorie der Kinnbildung, nach welcher eine Reduktion des gesamten Kiefers, insbesondere aber des Kieferkörpers in dorsaler Richtung stattfand mit Ausnahme der vorderen Basalpartie, welche unter dem Einfluss der Muskeln steht, die bei der artikulierten Sprache tätig sind" (p. 974).

WATERSTON, PROF. [Discussion of the Piltdown skull.] *Abstr. Proc. Geol. Soc. London*, session 1912-13, p. 25. December 28, 1912. (See also *Quart. Journ. Geol. Soc. London*, vol. 69, p. 150. March, 1913. Issued April 25, 1913.)

Very difficult to believe that the two specimens could have come from the same individual.

WATERSTON, DAVID. The Piltdown Mandible. *Nature*, vol. 92, p. 319, figs. 1-3. November 13, 1913.

Compares with chimpanzee and concludes that "... it seems to me to be as inconsequent to refer the mandible and the cranium to the same individual as it would be to articulate a chimpanzee foot with the bones of an essentially human thigh and leg."

WOODWARD, A. SMITH. The Piltdown Skull. *Brit. Med. Journ.*, vol. 2 for 1913, p. 762. September 20, 1913.

Abstract of lecture before the British Association at Birmingham on September 16. Announcement of discovery of canine tooth (see also next title). "As to the question whether the ape-like mandible belonged to the skull, it could only be said that its molar teeth were typically human, its muscle markings such as might be expected, and that it was found in the gravel near the skull." "The Piltdown man might ... well have been the direct ancestor of modern man, connecting him with the undiscovered tertiary apes, whose rounded skulls must have resembled those of the immature young of existing apes."

WOODWARD, A. SMITH. The Piltdown Skull. *Nature*, vol. 92, pp. 110-111. September 25, 1913.

Abstract of lecture before the British Association at Birmingham on September 16. Announcement of discovery of canine tooth. "This tooth corresponds exactly in shape with the lower canine of an ape, and its worn face shows that it worked upon the upper canine in the true ape fashion."

WOODWARD, A. SMITH. Note on the Piltdown Man (*Eoanthropus dawsoni*). *Geol. Mag. n. s.*, dec. 5, vol. 10, pp. 433-434, pl. 15. October, 1913.

WOODWARD, A. SMITH. A Guide to the Fossil Remains of Man in the British Museum, pp. 1-33, pls. 1-4, figs. 1-12. 1915.

Contains photographs of the Piltdown remains (pls. 1-4). These should be compared with the wash drawings in Dawson and Woodward, April 25, 1913, particularly as regards the teeth.

## EXPLANATION OF PLATES

## PLATE 1

All figures about  $\frac{3}{4}$  natural size. Casts.

- FIG. 1. *Pan* sp. Africa: no exact locality. No. 84655, U. S. National Museum.  
 FIG. 2. *Pan vetus*, England: Piltdown.  
 FIG. 3. *Pan* sp. Africa: French Congo. No. 174700, U. S. National Museum.  
 The casts of the African specimens have been mutilated as nearly as possible in the same manner as the fossil.

## PLATE 2

All figures about  $\frac{3}{4}$  natural size. Casts, except nos. 1", 2" and 4.

- FIG. 1. *Pan* sp. Africa: no exact locality. No. 84655, U. S. National Museum.  
 FIG. 2. *Pan vetus*, England: Piltdown.  
 FIG. 3. *Pan* sp. Africa: French Congo. No. 174700, U. S. National Museum.  
 FIG. 4. *Pan* sp. Africa: southern Kameroun. No. 176226, U. S. National Museum.

Fig. 2" is copied from the photograph published by Dr. Woodward in the Guide to Fossil Remains of Man in the British Museum, pl. 4. Note that enamel on lingual side of metaconid has flaked off from m, in fig. 4.

## PLATE 3

Skull greatly reduced, mandible about  $\frac{3}{4}$  natural size.

- Homo* sp. Skull, North American Indian, No. 262540, U. S. National Museum;  
 mandible, Mongolian, No. 278783, U. S. National Museum.

To show the association of cranial and mandibular characters normal in the *Hominidae*.

## PLATE 4

Skull greatly reduced, mandible about  $\frac{3}{4}$  natural size.

- Pan* sp. African: southern Kameroun. No. 176226, U. S. National Museum.  
 To show the association of cranial and mandibular characters normal in the *Pongidae*.

## PLATE 5

All figures about  $\frac{2}{3}$  natural size. Nos. 1 and 3 from casts.

Mandible of four adult individuals of recent *Pan* to show individual variation. Note particularly the symphysis, the sigmoid notch and the angular region.

- FIG. 1. *Pan* sp. Africa: no exact locality. No. 84655, U. S. National Museum.  
 FIG. 2. *Pan* sp. Africa: French Congo. No. 174710, U. S. National Museum.  
 FIG. 3. *Pan* sp. Africa: French Congo. No. 174700, U. S. National Museum.  
 FIG. 4. *Pan* sp. Africa: southern Kameroun. No. 176244, U. S. National Museum. (Coronoid process restored.)





1 and 3, PAN SP. AFRICA (RECENT),  $\times \frac{3}{4}$

2, PAN VETUS. ENGLAND (PLEISTOCENE),  $\times \frac{3}{4}$

The casts of the African specimens have been mutilated as nearly as possible in the same manner as the fossil



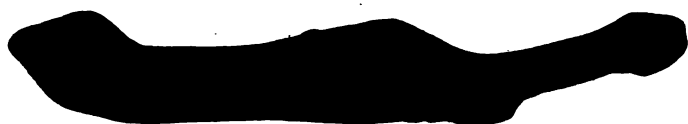




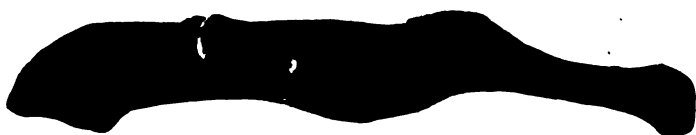
1



2



3



1'



2'



3'



1''



2''



4

1, 3, and 4, PAN SP. AFRICA (RECENT),  $\times \frac{1}{2}$ 2, PAN VETUS. ENGLAND (PLEISTOCENE),  $\times \frac{1}{2}$ 

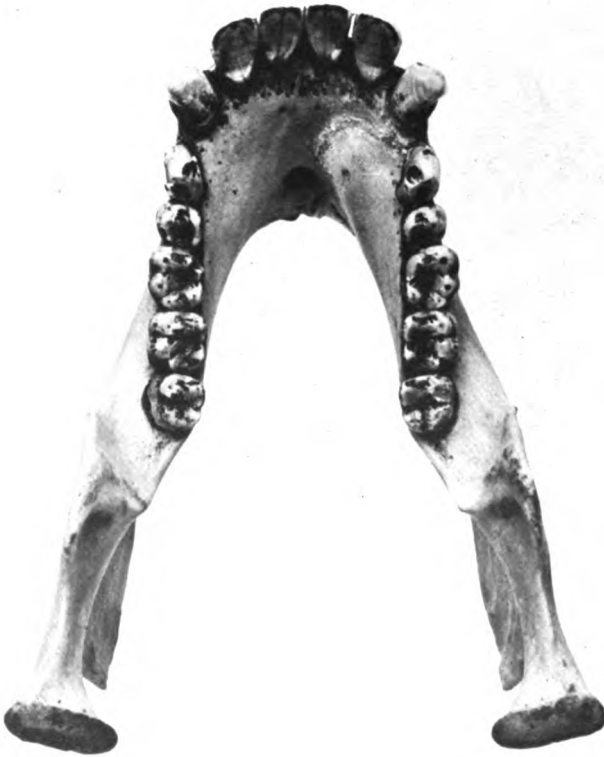
The casts of the African specimens have been mutilated as nearly as possible in the same manner as the fossil





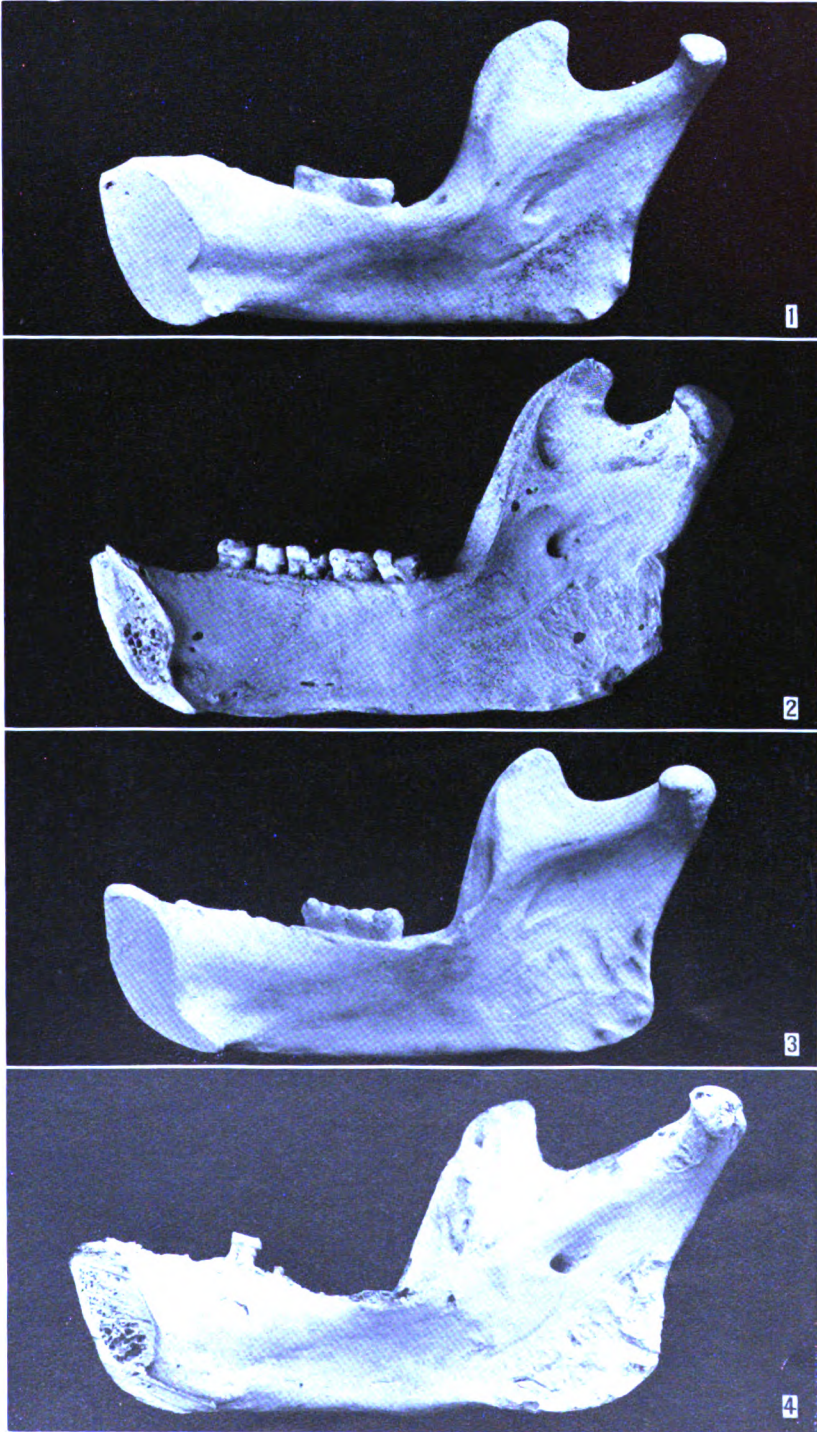


HOMO SP. (RECENT). SKULL GREATLY REDUCED, MANDIBLE  $\times 2$   
To show the association of cranial and mandibular characters normal in the Hominidæ



PAN SP. (RECENT) SKULL GREATLY REDUCED, MANDIBLE  $\times \frac{1}{2}$   
To show the association of cranial and mandibular characters normal in the Pongidae





PAN SPP. (RECENT),  $\times \frac{1}{2}$   
To show variations in form of mandible





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DESCRIPTION OF THE SKULL OF AN  
EXTINCT HORSE, FOUND IN  
CENTRAL ALASKA

(WITH TWO PLATES)

BY

OLIVER P. HAY

Research Associate of the Carnegie Institution of Washington



(PUBLICATION 2181)

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